

## **CHAPTER 7**

# **PRESENTATIONS**

Presentations are an important tool within the Command Religious Program. They are used by chaplains and religious education (RE) instructors to entertain, to persuade, to inform, and to instruct an audience or a class. Quite often, the chaplain or the RE instructor will use audiovisuals in a presentation to reinforce the message or idea to be communicated. Religious Program Specialists (RPs) provide chaplains and volunteer RE instructors the audiovisual and presentation support they need in order to make their presentations. This chapter will provide the RP with the basic information necessary to perform these and other related tasks.

### **RELIGIOUS EDUCATION PRESENTATIONS**

In addition to providing audiovisual and presentation support to chaplains and RE instructors, Religious Program Specialists are required to instruct and assist volunteer personnel in religious education methods and in the use of religious educational material. RE instructors must have certain fundamental skills in order to make their presentations and to teach effectively. The degree of audiovisual support required by RE instructors will depend upon their knowledge of the learning process and of basic instructional techniques.

Religious Program Specialists must be able to instruct volunteer personnel as to the learning process, use of instructional techniques, types of audiovisual aids, selection of audiovisual aids, and basic presentation support. These areas will be discussed in this chapter,

### **THE LEARNING PROCESS**

Learning is defined by Webster as the “acquisition of knowledge or skill” but few instructors have actually analyzed the learning process to determine just how this “acquisition of knowledge or skill” occurs. It is generally accepted, however, that learning occurs in response to sensory stimuli—seeing, hearing, feeling, tasting, and smelling.

The stimulation of one or more of the five senses is the first step in the learning process. Volunteer RE instructors must provide the sensory stimulus necessary for RE students to receive new information. This new information must be relevant and help achieve the learning objectives of the lesson.

The second step in the learning process is the student's response to the sensory stimulus of the instructor. The change that takes place in the student as a result of sensory stimulus represents the “acquisition of knowledge or skill” or more simply—learning. The RE instructor can be guided by two factors. First, the more well-placed, timely sensory stimuli the student receives, the better the chance that learning will occur. Second, the more vivid the stimuli, the better the chance that learning will occur.

The stimulation of two senses, sight and hearing, can make a far more vivid impression upon the student than the stimulation that only one sense could make. Experiments have shown that about 75% of what a person learns is acquired through the sense of sight, whereas only about 13% is acquired through the sense of hearing. The phrase, “a picture is worth ten thousand words,” does, in fact, contain an element of truth. It is important to remember that the senses are most effective in combination with

one another. Sight and hearing together produce a more vivid and lasting impression than either sight or hearing alone could produce. The other senses are effective to a lesser degree. Figure 7-1 is a graphic comparison of the amount of learning an individual would normally acquire through each of the five senses.

### TEACHING PROCEDURE

There are several methods that may be employed by RE instructors in teaching a lesson. Those most frequently used are the lecture, the discussion, and the demonstration. Occasionally, only one of these methods is best suited for an entire lesson. In most cases, however, a combination of the three methods will prove most effective.

Effective teaching follows a definite, well-established procedure that has proved effective for most training programs. This procedure consists of four major steps. First, it is necessary to prepare students to a degree where they are ready to learn. This is called the WARMUP step. Second, the new material is presented to the students: this constitutes the PRESENTATION step. The third step, APPLICATION, provides students an opportunity to practice what they have learned. The fourth and final step, TESTING, enables the instructor to evaluate the results of his instruction.

#### Warmup

The first of four steps in teaching (warmup) serves a dual purpose. It prepares the minds of

students to receive the new information and it arouses interest in the subject. The skill of an RE instructor is tested in this step. The instructor must be able to determine whether or not students have knowledge on which the new information may be built. The instructor must also create an interest and a desire on the part of the students to learn the new material.

Students can interpret new information only in terms of past experiences. In a well-organized program, each lesson forms a foundation on which to build succeeding lessons. However, in introducing new subject matter, it may be necessary to build on experience that students have acquired prior to the course of instruction.

In introducing the new lesson and correlating it with previous lessons, the RE instructor must try to arouse the students' interest. It is useless to attempt to teach until the teacher has captured the interest and attention of the students. Remember that the purpose of the warmup is to motivate the trainees to learn. The RE instructor may use a variety of techniques to create interest and capture the students' attention.

#### Presentation

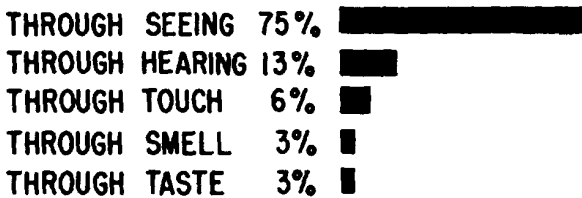
In the warmup, students are being prepared to receive new ideas and information and to have their interest aroused in the subject. They receive very little, if any, new information. The presentation step, as the name implies, consists of presenting the lesson in a clear, concise, and logical manner so that maximum learning takes place.

Various methods and devices have been developed for carrying out this instructional procedure.

In choosing teaching tools, the RE instructor must decide whether to use the TELLING, SHOWING, or DOING method, or a combination of these methods. In general, the method of instruction to be followed in the presentation step is determined by the subject, the aim of the lesson, the equipment available, and the qualifications of the students.

Following the presentation of each major point in the assignment, the RE instructor should check to make sure that the students

### THE LEARNING PROCESS



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Figure 7-1.—Graph of the learning process.

understand the material presented. At the close of the presentation period, the major points covered in the lesson should be summarized. This should enable students to organize the material in their minds and provide for better retention.

At the close of the presentation, students cannot reasonably be expected to have learned all that was discussed in the lesson. Instruction cannot be terminated at this point. To do so would give the students no opportunity to reinforce their learning by application, and would not permit the RE instructor to check the results of instruction by testing. Therefore, it is necessary that the remaining steps in the teaching process be completed before the training can be said to be complete.

### **Application**

The third step in instruction demonstrates the fact that one learns by doing. The application step permits students to utilize the ideas they have acquired in the presentation under the guidance of the RE instructor. It also offers the instructor an opportunity to observe the performance of each individual and to correct the student's errors. Teaching continues, and the RE instructor is given an opportunity to answer questions pertaining to the lesson. The instructor must make further explanations, and give additional demonstrations, but no information should be offered which was not included in the presentation step. Students must be given ample opportunity to practice what they have learned.

### **Testing**

The fourth and final step in the teaching procedure is testing. When reasonably sure that students understand the lesson, the RE instructor can help them clarify their knowledge by testing. In a test, students function without supervision. It must be remembered that in the application step, the students' work was constantly under the instructor's direction. They could ask questions, and wherever possible, errors were identified and corrected. In a test, the responsibility is their own, so the RE instructor may learn exactly how much they know and

what weak points will require additional instruction.

Many devices may be used to test the knowledge or skill the students have acquired. The means the RE instructor uses to determine the effectiveness of instruction and the relative achievement of learners constitutes the testing. Students also learn to what extent they have mastered the subject matter. The most common means of testing include work projects, practical performance tests, written tests, oral tests, or a combination of these. The timing and means of testing utilized will depend in large measure upon the nature of the material being taught. It may be more practical to test achievement upon the conclusion of a unit of instruction rather than upon the completion of each lesson.

### **The Lesson Plan**

The ability to plan a presentation or lesson so that the content can be presented in an orderly and precise manner is a basic requirement for instruction. If effective lesson plans are prepared for each presentation or lesson, the students will find it easier to understand and remember the material that is being presented.

The lesson plan is an organized outline of a single topic taken from the course of study and developed in detail, showing the specific knowledge and/or skills to be taught by the RE instructor during one particular session.

The lesson plan is an indispensable guide for the RE instructor in that it tells the instructor what to do, in what order to do it, and the procedure to follow in teaching the material. A lesson plan prevents teaching from becoming haphazard, as might otherwise be the case if the instructor depends upon memory for all the items to be taught and the proper sequence of such items. A variety of forms may be used to prepare a lesson plan. Regardless of the form used, however, there are several definite component parts which must always be included in a lesson plan:

- **Title:** The title should briefly convey the subject matter which is to be presented.

● **Learning Objective:** The learning objective states what knowledge and skill(s) the students should have acquired upon completion of the lesson.

● **Instruction Time:** The instruction time is the time which is available for the instructor to complete the lesson.

● **Instruction Aids:** The instructor should select the aids which will be most effective in presenting the skill(s) and knowledge that are to be gained in the lesson. Charts, slide presentations, filmstrips, motion picture film, are some of the aids which may be used. The instructor must take into account, however, the limitations of the instructional aids that are available for use in the lesson.

● **Reference Material:** A list should be made of the references from which the lesson material was drawn, such as, Unified Religious Education Curriculum for the Armed Forces.

● **Teaching Method:** The method or combination of methods best suited to present the material to be covered should be selected—discussion, demonstration, or lecture.

● **Motivation:** The instructor lists the method or techniques which are to be used to gain the interest and attention of the students. In some instances, goals may be set, encouraging remarks may be offered, honor roll or competition with self and others may be used as the motivating force.

● **Student Application:** The application outlines the manner in which the students can demonstrate the skill or ability they have acquired during the presentation. This affords the instructor an opportunity to observe the performance of each individual and to correct errors.

● **Summarization:** The instructor briefly outlines the material that has been covered—stressing the most important steps or ideas presented. The instructor answers questions, makes demonstrations, and gives further explanations, as needed. However, no new

information should be presented at this time. Summarization is an important part of the lesson as the learning can be reinforced at this time.

## **AUDIOVISUAL AIDS**

Audiovisual aids are defined as any device used to aid in the communication of an idea. From this definition, virtually anything can be used as an aid, providing it successfully communicates the idea or information for which it is designed. In this chapter, we not only use the term “Audiovisual Aids” but “Instructional Aids,” “Teaching Aids,” “Audio Aids,” and “Visual Aids” as well. An audiovisual product is any audiovisual (AV) item such as still photography, motion picture, audio or video tape, slide or filmstrip, that is prepared singly or in combination to communicate information or to elicit a desired audience response. Even though early aids, such as maps and drawings, are still in use, advances in the audiovisual field have opened up new methods of presenting these aids, such as videotapes and multimedia equipment which allow more professional and entertaining presentations to be presented. Most of the visual aids covered in this chapter can be grouped into the following categories—nonprojected aids and projected aids.

### **NONPROJECTED AIDS**

Nonprojected aids are those that do not require the use of audiovisual equipment such as a projector and screen. Included in this category are charts, graphs, maps, illustrations, photographs, brochures, and handouts.

#### **Charts**

Charts are in common use almost everywhere. A chart is a diagram which shows relationships. An example of a chart is shown in figure 7-2. The organizational chart is one of the most widely used. This chart shows the various branches of a particular organization. Air and sea maps that are used for navigation purposes are also charts.

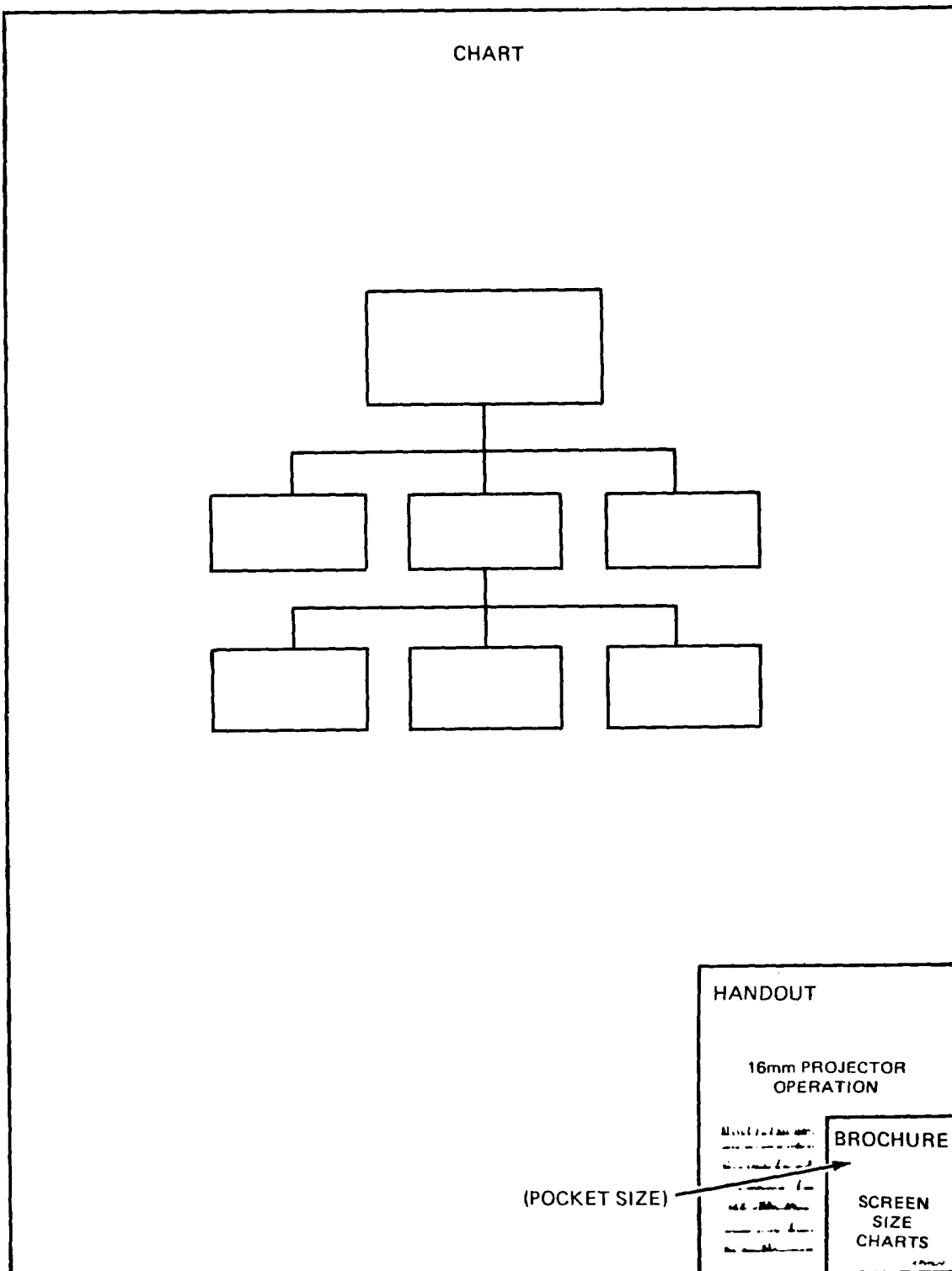


Figure 7-2.—Nonprojected aids.

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## **Graphs**

These aids show comparisons between figures. Four types of graphs are illustrated in figure 7-3. The bar graph is one of the most commonly used. Graphs are useful when the information being presented compares figures from time to time or from several sources. For example, a budget meeting may utilize graphs to show the increases and decreases of the budget over several years.

## **Maps**

Maps are graphic representations of the surface of the earth. Maps are usually drawn to scale. The type that you are most likely to encounter is the world map, used in conference rooms, classrooms, and in briefing rooms.

## **Illustrations**

Illustrations are the most versatile of any aid covered here. All aids make use of illustrations to some degree in their planning stages, and perhaps even in their final form. Charts, cartoons, maps, and signs are illustrations that are often used to present or clarify an idea.

## **Photographs**

Photographs may be passed from hand to hand or posted on a board in front of an audience. They can be used most effectively in small groups. Photographs are extensively used for documentation purposes.

## **Brochures and Handouts**

Brochures are small pamphlets composed of illustrations and printed material, but they are generally much briefer than handouts. When given to students or an audience, these materials should help the people understand the presentation. Handouts are normally retained by the audience for purposes of reference and later review. Long after the presentation, they can be used to review important points of the presentation.

## **PROJECTED AIDS**

Projected aids are those that require audiovisual equipment in order to be presented properly. Some of the aids included in this category are slides, filmstrips, overhead transparencies (vu-graphs), and motion pictures. It is important to remember that most nonprojected aids may be adapted for use as projected aids. A chart, for example, can be photographed and made into a slide.

### **Slides and Filmstrips**

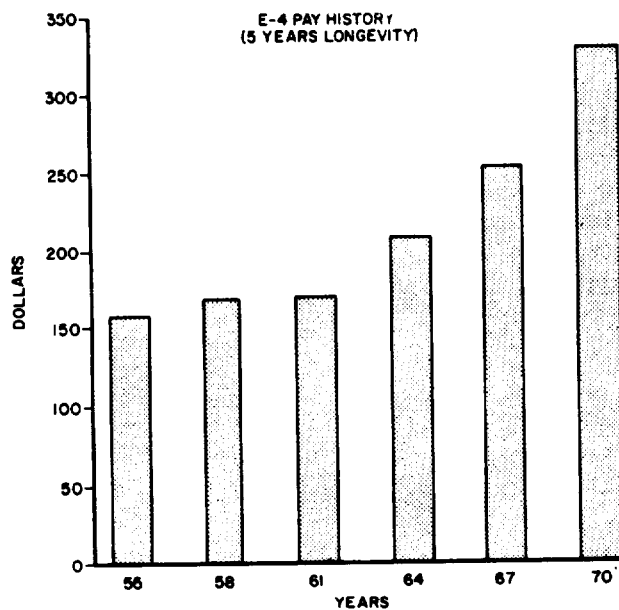
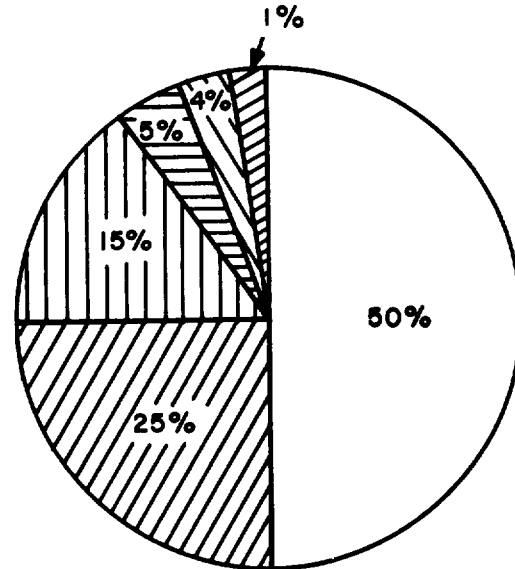
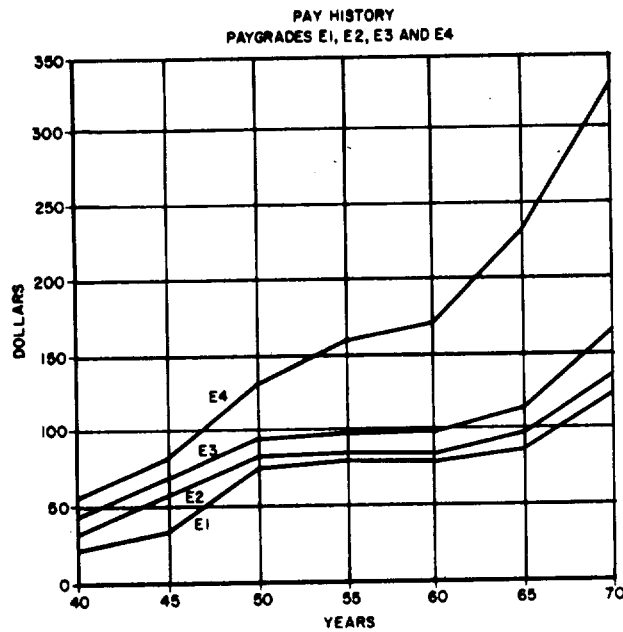
Anything that can be photographed can be made into a slide. Slides are one of the best known projected aids. They are found in all types and levels of briefings, both informative and educational. Presentations utilizing 35-mm slides can be both informative and educational, while at the same time they can be relatively inexpensive to produce. Filmstrips are used primarily in an educational environment. Each frame of the 35-mm filmstrip is related to others in such a way that an entire story or lesson can be contained in one strip. A major disadvantage of filmstrips is that they cannot be repaired (spliced) without losing a portion of their information.

### **Transparencies**

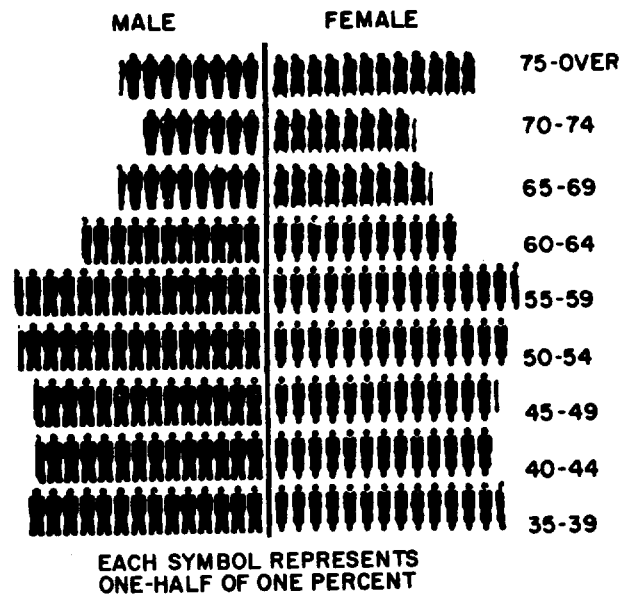
As used here, transparencies refer to large vu-graph transparencies projected with overhead projectors. Depending on time factors, the information to be presented, and the quality of transparency desired, production methods may vary from typed information on clear plastic to complex illustrations on colored film. The standard size is 7-1/2 x 9 inches (19 x 23 cm).

### **Motion Pictures**

Motion pictures have received extensive use in training and information programs. Until recently, 16-mm motion pictures were the primary visual aid in many programs. However, 16-mm films are expensive to produce, often more general in nature than is required by the course curricula, and they often become



POPULATION FORECAST OF U.S. FOR YEAR 2000  
BY AGE AND SEX



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Figure 7-3.—Most statistical material can be made clearer, more vivid, and more interesting through the use of graphs which fall generally into one of four categories: line, bar, pie, and picture.

obsolete in a short time because of changes in policy, equipment, or procedures. Eight-millimeter (8-mm) single-concept films have replaced 16-mm motion pictures in many instances because 8-mm films are less expensive to produce, require less expensive equipment for presentation, and can be more easily geared to present a single idea or concept.

## **OTHER AIDS**

The audiovisual field is becoming increasingly sophisticated from the equipment or hardware standpoint. Technological advances have made available relatively inexpensive audio and video tape recorders and various types of programmers and synchronizers so that the chaplain and the RP can produce and present high quality audiovisual presentations.

### **Audio Tape**

The majority of audiovisual presentations utilize audio tapes to some extent. A combination of prerecorded audio tapes, usually a cassette, and appropriate 35-mm slides is called a multimedia presentation. The tape track or channel is recorded with the narration and the change signal is recorded on the remaining channel. After the tape and slides are coordinated, the audience hears the narration while the recorded synchronizer sends a command to the projector, and changes the slides at the appropriate place in the narration.

### **Video Tape**

Cassettes are now available to each audiovisual library that is equipped with the proper equipment (cassette player and monitor). The video cassettes are cost-effective because they can be reused many times. The use of prerecorded video tapes is expected to save money during the production of these aids. A minimum of motion picture prints can be produced and video cassettes can be recorded for unexpected requests, then after the cassettes are no longer required, they can be erased and used for a new subject.

## **THE SELECTION AND USE OF AUDIOVISUAL (AV) AIDS**

Audiovisual aids are valuable tools which can help RE instructors reinforce religious education and make learning more interesting to students. In order for this to occur, however, every RE instructor must know how to select the most effective AV aids, determine which audiovisual aids are available, and know how to use them effectively.

Inasmuch as audiovisual aids are so beneficial, it is quite likely that some RE instructors may depend too much upon them in their classes. The RE instructor may, in fact, conclude that the use of audiovisual aids can accomplish practically all of the instruction, but this is a very serious misconception about the function and use of AV aids. RE instructors must be taught that audiovisual aids are used only to supplement training. Audiovisual aids are designed to clarify and speed up instruction but they cannot take the place of the instructor. Some RE instructors mistakenly assume that the more audiovisual aids they use in their classes, the better their teaching will be. Their classes can become a kind of juggling act, a frantic shuffling back and forth from one type of training aid to another. A basic principle to bear in mind when employing audiovisual aids is that a few AV aids utilized well will have better instructional results than a confusing array of aids which are presented so rapidly that sufficient time is not given for the students to understand the material presented.

How should RE instructors select from among those audiovisual aids which have been approved for religious education? When should audiovisual aids be used together in the same lesson? The answer to these questions is that an audiovisual aid (or aids) should be utilized only when it can assist in achieving the learning objective. The following principles will guide the instructor in the selection and use of the audiovisual aids which have been approved for use in a command's religious education program:

- The audiovisual aid must be reviewed to ensure that the material it presents is relevant to



the lesson and that it conveys or clarifies the learning objectives of the lesson.

When a motion picture is used, the instructor should outline the purpose of the film, indicate ideas, actions, or points to be noted in the film or questions that may be answered in the film. After the film has been shown, the instructor should question the students or lead a group discussion to ensure that the students have become acquainted with and understand the material presented in the film.

- When an audiovisual aid is a motion picture, the connection between the lesson and the film must be made clear to the class by the instructor. The instructor should prepare the class prior to showing the film by indicating the points in the film to be noted, the new concepts that will be brought out by the film, and the questions answered by the film. When the showing is over, the RE instructor should have the students summarize the film. The instructor may find it necessary to summarize the film to clarify the material presented. This could then be followed by a group discussion.

- When charts, posters, mockups, or cutaway models are used as audiovisual aids, RE instructors should keep them covered until they are needed so they will not distract the students.

- An audiovisual aid must be integrated into the presentation to achieve maximum usefulness. The audiovisual aid should not create distracting breaks in the presentation, but should be used in such a way that the presentation flows smoothly, without interruption. To accomplish this, the RE instructor must plan in advance how and when audiovisual aids are to be used in the presentation. This should be incorporated in the lesson plan.

### **Requesting Religious Education (RE) and Audiovisual (AV) Materials**

Religious Program Specialists will often be asked to procure religious education (RE) and audiovisual (AV) materials. The use of RE resource guides developed by the Armed Forces

Chaplains Board and the *Chaplain Audiovisual Catalog* can be very helpful to the RP in these two important areas. The use of these resource guides and the *Chaplain Audiovisual Catalog* are discussed in the following paragraphs.

**RESOURCE GUIDES.**—Requests for religious education (RE) materials can frequently be met through the use of one of the various resource guides developed by the Armed Forces Chaplains Board for military chaplains. Resource guides utilized for 1981/1982 include:

- *Unified Jewish Religious Education Curriculum Resource Guide for the Armed Forces*
- *Protestant Armed Forces Resource Guide 1981-1982*
- *(Roman) Catholic Curriculum and Resource Guide*

These resource guides are made available to Navy chaplains by the Chief of Chaplains. Navy chaplains are encouraged to use the RE material which has been selected for inclusion in these resource guides. However, if none of the material listed in these resource guides is suitable, material found elsewhere which is required by the chaplain may be procured by open purchase. One example of this is "The Orthodox Church" which is not addressed in a resource guide. One source for Orthodox Christian (RE) materials is the:

Orthodox Christian Education Commission  
Sales Department  
P.O. Box 69, Calvin Station  
Syracuse, New York 13205

When materials are requested for a particular denomination which is represented within the Command Religious Program (CRP) but is not listed within a resource guide, such as "The Orthodox Church," the RP must determine where religious education (RE) materials for that denomination may be procured. This address should then be placed on file and a request made

for a catalog listing the (RE) materials available from that source.

THE CHAPLAIN AUDIOVISUAL CATALOG.—This catalog was published and distributed in the fall of 1978. All films purchased by the Department of Defense prior to the summer of 1978 are included in this catalog. All audiovisuals, films, slides, filmstrips, video-cassettes, of the Army, Navy, and Air Force are available at the following distribution points:

DN—Department of the Navy

NETSCLANT  
Naval Station—Bldg. W313  
Norfolk, VA 23511  
AUTOVON 690-3013  
804-444-3013

NETSCPAC  
Fleet Post Office Bldg. 110  
San Diego, CA 92132  
AUTOVON 933-8895  
714-235-8895

Training Support Center  
Marine Corps Base  
Camp Smedley D. Butler, Okinawa  
FPO, Seattle 98773

Requests for Army and Air Force audio-visuals can be directed to the Army and Air Force Military Department Audiovisual Products Library closest to the duty station.

Information re:

Army A-V:

Army Department Pamphlet 108-1

or

DA-Department of the Army

Training Support  
Training Support Detail  
Tobyhanna, PA 18466  
AUTOVON: 247-9927

Air Force A-V:

Air Force Manual 95-2

or

DF-Department of the Air Force

AVVS  
Norton Air Force Base, CA  
AUTOVON: 876-2475

Navy A-V

DN-Naval Audiovisual Center

Naval Station  
Washington, DC 20374  
AUTOVON: 288-4167

Requests should be directed to the appropriate sponsor/distributor service center by phone, memo, or the request form which is included in the Program Support Guide, NAVPERS 15992 series.

All Religious Program Support audiovisuals are divided into broad categories. These categories are identified as follows:

B. Behavioral and Social Sciences

12. Religion and Philosophy

- 12.1 Bible
- 12.2 Chaplain Duties
- 12.3 Family Counseling
- 12.4 Marriage Counseling
- 12.5 Moral Development
- 12.6 Religious Practice
  - 12.61 Catholic
  - 12.62 Jewish
  - 12.63 Protestant

Films and filmstrips for use in Navy and Marine Corps religious programs are funded through the Office of the Chief of Chaplains. New films are reviewed on a continuing basis, and those selected are purchased and placed in the Navy's film system.

The selected films and filmstrips are placed in the training aids libraries as listed in the Program Support Guide, NAVPERS 15992 series.

Titles of new films and filmstrips are regularly published in "ITEMS OF INTEREST." This publication is written for chaplains and Religious Program Specialists by the Office of the Chief of Chaplains.

### **Dry Runs**

A "dry run" refers to a practice presentation, RPs who assist in the dry run have specific responsibilities. They have to get everything ready for the dry run. This includes making the presentation room ready by selecting, setting up, and adjusting any audiovisual equipment to be used. They should also be present to assist in any other way needed.

All AV presentations given to distinguished persons, either at local commands or elsewhere, should be preceded by at least two dry runs. Other presentations should be preceded by at least one dry run before the actual presentation.

Dry runs help to ensure accurate timing of the audiovisual aids. They help to harmonize the RPs' performance, if they are assisting in the actual presentation, with that of the speaker so that an illustration or a slide can be changed without the speaker having to stop or change his timing. While dry runs are required for the speaker to revise his speech and improve his techniques, they also provide the RP with the opportunity to plan, prepare, and practice so that a flawless presentation of the AV material can be achieved.

### **Cleaning and Preservation of AV Aids**

The most effective maintenance procedure which can be implemented for AV aids is preventive maintenance. The preventive maintenance procedures described here primarily relate to projected aids. The cleaning of projected aids is generally restricted to their bindings. The term "binding" refers to the mounting frames which enclose overhead transparencies and 35-mm slides. Transparencies and slides should be handled by their bindings. The transparent parts should not be touched. It is strongly recommended that clean gloves be worn when these projected (AV) aids are handled; otherwise, they may become soiled. When not in

use, the slides and transparencies should be stored in dry, dust-free containers. Pencil marks, fingerprints, and smudges may be removed from (AV) bindings by carefully rubbing them with an art-gum eraser. Dust which is found on plastic overhead transparencies, 35-mm slides, glass slides, and filmstrips may be removed by using a clean lint-free cloth. Fingerprints and other surface accumulation on the film may be removed by using a cloth moistened with a nontoxic, nonflammable, film-cleaning fluid. This fluid, however, will not remove scratches or fill perforations in the emulsion of photographic slides. When the bindings or frames of slides or overlays become overly soiled or worn, the RP should initiate an audiovisual activity job order, OPNAV 3160/16, through the appropriate channels to have the bindings replaced. In the case of worn or damaged overlays or slides, the RP should request that the overlays or slides be replaced.

## **PRESENTATION SUPPORT**

Religious Program Specialists are required to assist with audiovisual presentations. In this section the various tasks involved with presentations will be discussed. Whether a presentation goes smoothly depends, to a great extent, upon how well the RP accomplishes these tasks.

Some of the tasks involved with presentations include (1) arranging the room in which the presentation will take place, (2) adjusting the room lighting and temperature, and (3) selecting or setting up the audiovisual equipment required to support the presentation.

### **PREPARATION OF FACILITIES**

Presentation facilities vary from command to command. The problems the RP will encounter in getting these facilities ready for a presentation are largely determined by the type of room and the types and amount of equipment available.

#### **Arrangement of Furniture**

The most elaborate facilities are generally to be found at large shore commands. These

facilities are generally equipped to meet the needs of command briefings and presentations to a wide variety of audiences. When a presentation room lends itself to different types of presentations, one of three styles of furniture arrangements will usually be employed. These styles are theater style (chairs only), combination of chairs and tables, and an arrangement of tables only.

**THEATER STYLE (CHAIRS ONLY).—**Some presentations and briefings employ a chairs-only arrangement. In such cases the chairs are arranged in rows much like a movie theater seating arrangement. In some presentation facilities, the chairs may be fixed to the floor facing the screen. Seating capacity can be increased through the use of folding chairs. Projected material presented in this type of room may come from a projection booth behind the screen. The booth is physically separated from the presentation room by a wall and rear projection screen.

A chairs-only arrangement offers advantages as well as disadvantages. The chairs are firmly attached to the floor, eliminating any possibility of using another arrangement style. A theater-style arrangement with portable chairs makes the rapid conversion to another style possible, if needed.

When arranging a room with portable chairs, the first row of chairs should not be placed too close to the screen; enough space should be left between the rows to provide leg room for the audience. Wide aisles should be left to take care of traffic.

**TABLES AND CHAIRS.—**Some official military presentations are attended by personnel of different levels of authority. Sometimes personnel of higher echelons are seated around tables, while the personnel of lower echelons are seated in chairs arranged in theater style. The tables and the lectern are arranged in front of the room; that is, nearer the screen. The chairs in which those of lower echelons will sit are arranged behind the tables. Additional chairs can be placed on either side of the table to take care of a larger number of people.

**TABLES ONLY.—**At top level presentations, attended by a few high ranking individuals, a tables-only arrangement may be appropriate. The table should be long enough to seat people conveniently along the side. Another feature of the table arrangement is that everyone seated at the table has a clear view of the projection screen, if one is utilized.

### **Audience Comfort**

Regardless of how good a speaker is or how interesting the presentation may be, people in the audience will have difficulty paying attention for a long period of time unless they are comfortable. It is the responsibility of the RP to make the audience as comfortable as possible during the presentation. Some of these conditions may, however, be beyond the control of the RP.

Physical comfort is a necessity if the audience is to concentrate on a presentation. Nothing will distract a person more completely than a constant feeling that "It's too cold to think"; "It's so hot I cannot concentrate"; "The room is so stuffy that I am drowsy"; "The light is so glaring it hurts my eyes"; "The light is so poor I cannot see"; "It's so noisy I cannot hear." The members of the audience may not express these sentiments to the speaker, but they will certainly discuss them among themselves. These are legitimate complaints that deserve attention. The comfort of the people who attend the presentation should be considered and steps taken to make them more comfortable wherever and whenever possible.

Special attention should be paid to the lighting and temperature. Controlling these conditions in most presentation facilities actually poses very few problems. With such built-in conveniences as thermostats for temperature, air-conditioning, and controllable lighting, the RP will have to do no more than turn a knob on a light dimmer, set the thermostat to control the temperature, or turn on the air-conditioning to make the room comfortable. However, rooms with windows and without air-conditioning require a little more initiative.

Lighting should be adequately controlled. Naturally the type of presentation influences, to

a large degree, the amount and type of lighting required. When nonprojected aids are being used, normal lighting of the room is satisfactory. When projected aids are being used, the required intensity of the lights will vary with the type of projector being used. The presentation room should not be totally dark when visual aids are projected on the screen. However, darkening a room sharpens the projected aid, brings out details, brightens the color, and helps hold the interest of the viewer. Too much light in the room makes viewing hazy and causes eyestrain. Random rays of light, especially at the side or near the screen, are distracters. Sometimes the effective use of nonprojected charts, graphs, or maps is prevented by the glare of light from a window. These conditions can be prevented through the proper use of shades and artificial lighting. Light intensity just below the level of interference with good viewing should be maintained. If the room has windows, and the windows are needed for ventilation, light from the windows may be controlled with venetian blinds or with baffles. Louvers may also be used to darken a room.

Heating and ventilation are very important, especially where windows must be used partially for regulating the heating and ventilation. Only in rooms equipped with self-regulating heating and ventilating systems is the RP relieved from the responsibility of regulating these factors. Humidity is another important factor in maintaining comfort. Even when the temperature is favorable, people may be uncomfortable if the humidity is too high. Humidity may not be controlled, but comfort will be greatly improved if the air is kept moving. The circulation of the air is usually accomplished by motor-driven fans or, if it is a breezy day, by adjusting the windows.

### **Overall Conditions**

The overall condition of a presentation facility should be clean and neat in appearance. A general inspection should be made after each usage of the presentation facility. The floor should be clean and free of debris. If smoking is permitted, ashtrays and ash stands should be emptied, cleaned, and evenly redistributed in the room. Some realignment of chairs is usually

necessary. The room's displayed articles, pictures, clock, calendar, flags, etc., should be visually checked to make sure they are in place and set up properly. The projection screen should be clean and free of smudges. If tables are used, a writing pad, pencils, and an ashtray should be set up at each conferee's position. Correct placement of nameplate holders at reserved positions is a must. Normally, seats are reserved for flag officers, distinguished visitors, deputy chiefs of staff, and staff members. Protocol prescribes the seating arrangement and can guide you in these matters. The proper seating of foreign dignitaries and religious leaders is very important. Questions about reserved seating arrangements may be discussed with the chaplain.

### **AUDIOVISUAL EQUIPMENT**

After arranging the presentation room, the audiovisual equipment must be selected and set up. The type of material to be presented must be determined; then the proper equipment and accessories compatible with the presentation facility should be selected.

#### **Projection Screens**

There is more to a projection screen than is readily apparent. It is true that images can be projected on a wall, a door, or a bed sheet. But that is not the best way to present a quality image. The surface of a projection screen is designed to reflect the most light possible. One of the most common types of screens is the glass beaded surface which is very bright, yields excellent color reproduction, and has a very wide viewing angle. The newer screens are seamless and are available in almost any size.

Another type of screen is the silver lenticular surface. It is described as lenticular because it controls light, much the same way as does a lens, by directing it to a predetermined area. Light that would normally be wasted through dispersion is reflected back to the audience. Images projected on a silver lenticular screen are as bright as the newest glass beaded surfaces. The viewing angle for this type of surface is approximately 90°. Lenticular screens work well in rooms that cannot be darkened, particularly if

the extraneous light comes from the side. When one is sitting too close to the screen, lines can be detected in the image. Silver lenticular surfaces are used only in tripod or wall mounts that have a tensioning device to hold the surface flat. It is important that these screens be positioned in an exact perpendicular relationship with the projector and at the eye level of the audience.

Another type of surface is the matte white which is a nonglass surface that diffuses the available light evenly across the surface. Because of this diffusion, image brightness is considerably less than with other screen surfaces. This type of surface does have some advantages. The image produced is pleasing, free from grain, and very sharp. Matte white screens are good for short projection distances and are, therefore, very effective in small rooms where the image brightness needs to be reduced.

**VIEWING ANGLE.**—The relationship of the screen to the audience is very important. As a rule the audience should never view the image from an angle greater than  $45^\circ$  from the projection axis or outside the viewing angle of  $90^\circ$ . Beyond this area the image will appear distorted regardless of the type of screen surface. Objects and characters appear to be taller and thinner and printed matter will be difficult to read. Figure 7-4 illustrates the relative placement of the audience for a given screen size.

**DETERMINING SCREEN SIZE.**—The Society of Motion Picture Engineers prescribes the 2 and 6 rule for determining the screen size when the size of the audience is known. It is a simple, easy to apply formula. The rule states that the distance from the screen to the first row of seats should equal 2 times the screen width, and the last row of seats should be at a distance

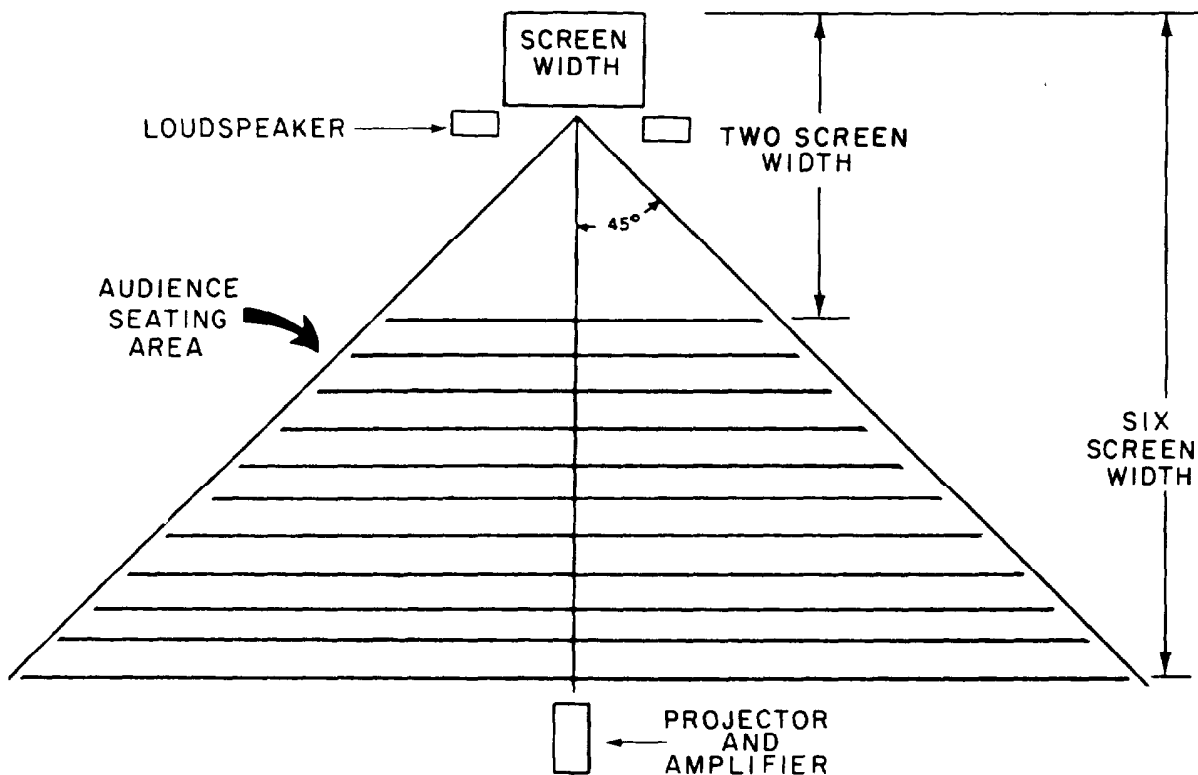


Figure 7-4.—Seating arrangement in relation to the screen.

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that is 6 times the width of the screen. This rule fits the screen to the audience and not to the projector. To make the image conform to the screen size, the proper lens must be selected. This rule works the same for all screens including rear projection. For satisfactory viewing, a row of seats should be no wider than its distance from the screen.

**PERMANENT SCREENS.**—There are several types of built-in screens. Some are portable screens that have been mounted on a wall—the screen can be pulled down when needed and retracted when not in use. Another type is a wall-mounted surface which is covered by draw curtains or sliding panels when it is not being used. A third type is one that is actually mounted on a sliding panel which can be rolled into a wall recess. Some screens are stored in ceiling recesses and are raised and lowered electrically.

When a presentation facility is not available, an appropriate portable screen that will fit the size of the room and the audience should be selected. When the chaplain or RP supervisor gives an assignment to assist with an audiovisual presentation, the RP should list the location, date, time of the presentation, and the type of AV equipment needed. With this information at hand, the RP should be able to rig the facility and assist in the conduct of the presentation with little difficulty.

When the audiovisual equipment and accessories that will be needed have been determined, the next step is their acquisition and testing. Procedures for mounting the components, as well as the testing and adjustment procedures for special equipment should be found in the manufacturer's instruction manual.

Having mounted all of the components, the RP should now be ready to set up the projector where it will be used. Presentation rooms with projection booths greatly simplify the problems of selecting and setting up equipment.

## **FINAL PREPARATION**

Attention to detail in the final minutes before a briefing will determine how well a presentation will go. Plenty of time to set up and

check the operation of the equipment before the presentation should be allowed.

The RP should setup the projectors and conduct an operational check. When a presentation consists of slide trays or transparencies, they should be arranged in their proper order of presentation. When operating any type of projector, the cooling fan should be running when the projector lamp is on. Operating a projector lamp without the cooling fan can cause serious damage to the projector.

The projector must be aligned with the screen. A sample transparency can be placed on the projector and the image adjusted vertically and horizontally to the screen; then the image can be focused. The cooling fan should always be left on for a few minutes after the projection lamp has been turned off to allow the unit to cool down.

Appropriate background music to entertain early arrivals is often desirable. The volume should be loud enough to be heard easily but not so loud that it interferes with normal conversation. The music should be gradually faded out as the presentation begins.

## **OTHER RESPONSIBILITIES**

Although not listed as part of the official duties of an RP, it is customary to assist the presenter in other areas of the presentation when requested. The RP may be called upon to distribute agenda or literature to the people in attendance or asked to take attendance. These are very minor tasks but they help to make the presentation go smoothly. Cooperation between the RP and the presenter is necessary if a successful presentation is to be achieved.

So far in this chapter, the importance, the planning, and the use of presentations for purposes of instructing, informing, persuading, and entertaining have been discussed. The use of audiovisual materials/equipment in these presentations, and the operation and routine maintenance of this equipment have been addressed. In order to make this job easier for the RP, and to serve as a ready reference in the operation and maintenance of audiovisual equipment, the final section of this chapter will be devoted to descriptions of the operation and

routine maintenance of the audiovisual equipment most frequently used by the Navy.

## **PROJECTION EQUIPMENT**

Audiovisual equipment plays a major role in the Command Religious Program. Religious Program Specialists are required to have the knowledge and expertise to operate this equipment in support of previews of audiovisual material; projectionist training, and volunteer teacher training; and assisting with presentations. This section introduces the RP to representative types of still projection equipment and motion picture projection equipment. Although the specific models of equipment discussed in this chapter may not necessarily be available, the principles of operation are the same for all models.

### **STILL PICTURE PROJECTORS**

Many types of still picture projectors are available for use with presentations. The more common of these types include overhead, opaque, lantern-slide, filmstrip, and 35-mm projectors. In many instances, the RP will be required to set up and operate these projectors, as well as prepare materials for use in them. Therefore, it is necessary to have a working knowledge of the operation of the various types of still picture projectors.

#### **Overhead Projector**

The overhead projector shown in figure 7-5 is used to project images from projectuals which are transparent and have a colored or opaque image. A desirable feature of the overhead projector is that it may be used in a room without turning off the lights. Additionally, the size of the projectual is large enough to allow the instructor to work directly on it while talking. By writing on clear acetate with a grease pencil, the instructor can create a projectual while teaching a class.

The projector can be set up on either side of the screen. For classroom use, it is normally located in front of the screen, allowing the

instructor to operate it while instructing the class. For command briefings, the projector is usually placed behind the screen so that it offers no distraction to the audience.

Proper placement of the projector requires the operator to consider the best possible arrangement for each situation. Several points to keep in mind are:

1. The projector should be placed on a table or stand at such an angle that the projected image will be nearly a perfect rectangle. Projectors not properly placed will result in an image that is keystone (wedge-shaped). In some cases it may be possible to adjust the angle of the screen.

2. Effort should be taken to ensure that each member of the audience will be able to see. It should be kept in mind that the farther the projector is moved from the screen, the less intense the projected image will be.

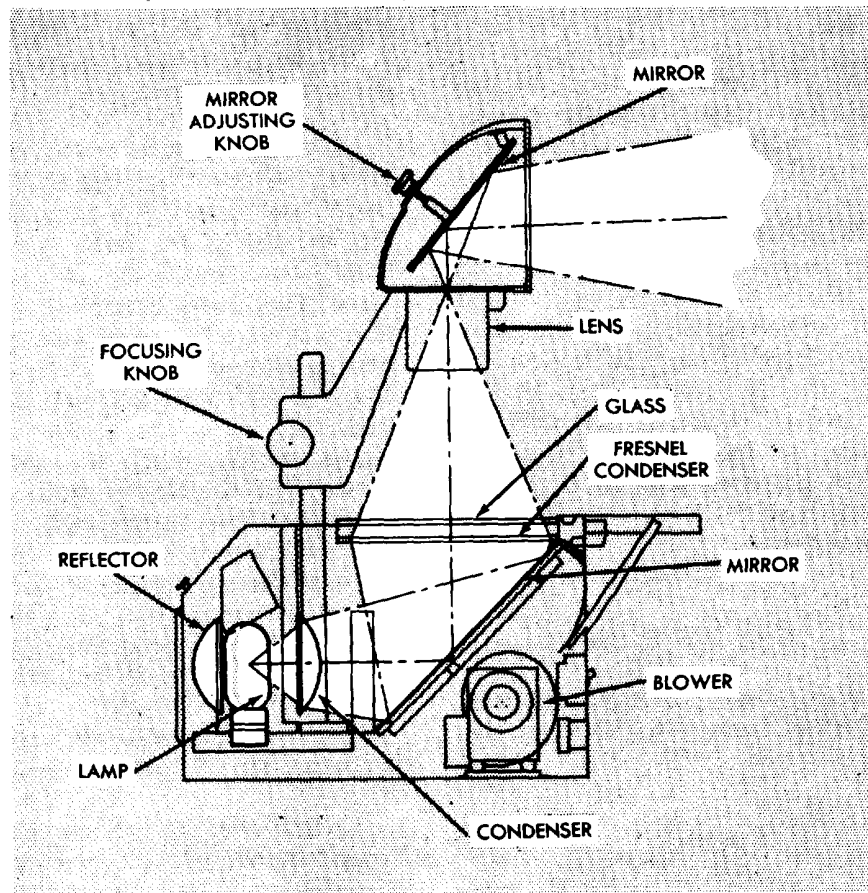
3. Projected images should be viewed without having to shift the eyes over too wide a range. Seating the audience at a distance no closer than twice the width of the image will take care of this requirement.

The location of the projector in relation to the screen will also affect the manner in which the projectuals are placed on the device. The bottoms of the projectuals are always placed so that they are facing the screen. Front projection, where the projector is located on the audience side of the screen, requires the projectuals to be placed so that they are readable to the operator. Rear projection, where the projector is located behind the screen, requires the projectuals to be placed face down, so that they are unreadable to the operator.

Operation of this projector is relatively simple. It involves nothing more than turning on the projection lamp, focusing the image, and positioning the image on the screen.

The projection lamp and blower motor may be controlled by a three-position switch. The first ON position provides power to the blower motor only; the second ON position provides power to both the projection lamp and the





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Figure 7-5.—Overhead projector.

blower motor; the third position is the OFF position. The purpose of this arrangement is to provide blower motor operation for cooling after the projection lamp has been turned off. If the heat was not removed by the blower, the projection lamp could be damaged. Also the blower motor maintains a constant temperature in the vicinity of the lamp when the lamp is on, prolonging the life of the lamp.

The following information is quite technical but is presented to help the RP understand how the projector works. This, in turn, may help RPs in the operation and maintenance of the equipment.

The source of illumination for the projector is a 1,000-watt projection lamp. A concave

reflector mounted behind the lamp reflects the light rays. The glass condenser lens gathers the light rays onto a 45° mirror which deflects the light upward toward the projection stage. Immediately beneath this projection stage is the specially designed Fresnel lens.

The Fresnel lens is used in projection equipment to minimize the effects of spherical aberrations (faulty focusing). One surface of the lens consists of a number of stepped facets. These facets are circular (similar to a phonograph record), concentric grooves that extend from the center of the lens to the edges. The slope of each facet is independent of the slope of all the other facets. These slopes are designed to provide a

perfect focus of the light rays which pass through the lens.

Directly above the Fresnel lens is the 10-inch by 10-inch projection stage where the projectuals are placed. The objective (projection) lens is supported centrally over the stage. This lens focuses the image of what is to be projected onto a 45° front-surface mirror, which in turn reflects the image to the screen.

Attachments may be provided that will allow the overhead projector to be converted into a device that will project 35-mm slides, 35-mm strip film, or lantern slides. Additionally, a polarized disk may be attached to the projector allowing specially prepared animation projectuals to be shown which will give the audience the effect of movement.

### **Portable Overhead Projector**

The portable overhead projector is a self-contained unit. (See figure 7-6.) Due to the



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**Figure 7-6.—Portable overhead projector.**

unit's portability, the space between the projection stage and projection head is limited. As a result, the use of this projector with overlay-type projectuals is limited.

A unique feature of this device is that the blower motor is thermostatically controlled. The thermostat maintains a constant temperature in the vicinity of the lamp which prolongs the lamp's life. When the two-position switch is turned ON, power is applied to both the projection lamp and the blower motor. When the air passing around the projection lamp is heated to 130°F, a thermostatic switch closes, providing a secondary path for electrical power to the blower motor. When the projector switch is turned OFF the blower motor will continue to operate until the thermostatic switch opens. The thermostatic switch will open when the temperature of the air passing around the projection lamp falls below 130°F. For this reason power should not be removed from the device until the blower motor shuts off automatically.

The overhead projector, shown in figure 7-7, is another type of portable self-contained unit.

Overlay-type projectuals that do not extend beyond the top of the viewing stage can be used with this projector.

This device uses a quartz iodine lamp instead of the standard projection lamp. The transparent envelope is made from quartz (instead of glass). Quartz resists heat and permits use of higher wattage. Caution must be observed when handling the quartz lamp. Stains from fingerprints can cause lamp failure. When lamp failure occurs, the lamp may explode when lighted. For this reason a safety switch cuts off the current to the lamp when the projector top is open.

### **Opaque Projector**

The basic difference between the opaque projector and the overhead type is that light is reflected from the surface of opaque objects rather than passing through them. (See figure 7-8.) Examples of opaque objects that can be

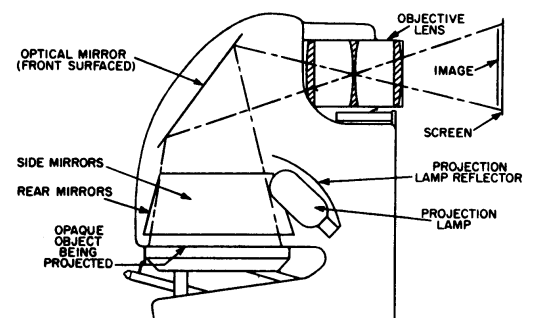


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**Figure 7-7.—Portable overhead projector.**

projected with this device are a page of a magazine or book, photographs, pictures in full color, charts and diagrams. Also, relatively flat physical objects such as small machine parts, cams, gears, coins, etc., can be projected. No special preparation of opaque objects is necessary in order to project them.

The opaque object projector can be used as a visual aid in teaching and briefing, for the presentation of progress charts and similar data, and for the comparison of small physical objects. It is extremely useful to enlarge drawings, maps, or photographs so that they can be accurately traced in complete detail.



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**Figure 7-8.—Opaque projector.**

The projector uses a 1,000-watt projection lamp, has a projection opening of 10 by 10 inches, and is equipped with a 4-1/2 inch diameter, 22-inch focal length lens. The projector is equipped with an opaque object holding device and a conveyor belt type loading mechanism which permits uninterrupted projection. The projector is provided with an optical pointer by means of which details anywhere on the screen can be pointed out by a projected light spot.

The roll feed assembly provides a means for handling opaque objects of any length and up to 10 inches wide. The thickness of the objects should not exceed one thirty-second of an inch. The feed assembly also permits inserting and removing the copy without lowering the platen (figure 7-9) assembly. The maximum size of the opaque object that can be projected at one time is 10 x 10 inches.

To operate the roll feed assembly, stand behind the projector and hold the crank in your right hand. Hold the copy in the left hand, face up, bottom edge toward the screen, and feed it into the left side of the projector. When the material is inserted approximately 1-1/2 inches,

turn the crank clockwise. The pressure created by the impelled air will hold the opaque object flat on the feed belt and when the crank is turned, the opaque object is carried into position. When the next opaque object is inserted, repeat the operation. Insertion of one opaque object automatically removes the previous one. To project thick objects (up to 1-1/2 inches thick), lower the platen assembly to the locked position and remove the roll feed assembly by lifting it off. Place the opaque object upon the platen assembly and let it rise as far as it will go. Apply a continuous pressure downward on the platen handle to prevent the platen assembly from snapping upward when you release the lock.

Although thick physical objects (not lying in one plane) can be projected, only one plane of the object can be brought into focus at one time. Other planes can be brought into focus by rotation of the focusing knob. However, when an object is not too thick, good definition can be obtained over its entire thickness.

The projector should be positioned on a suitable table in the projection room. The table should be high enough to project the image over

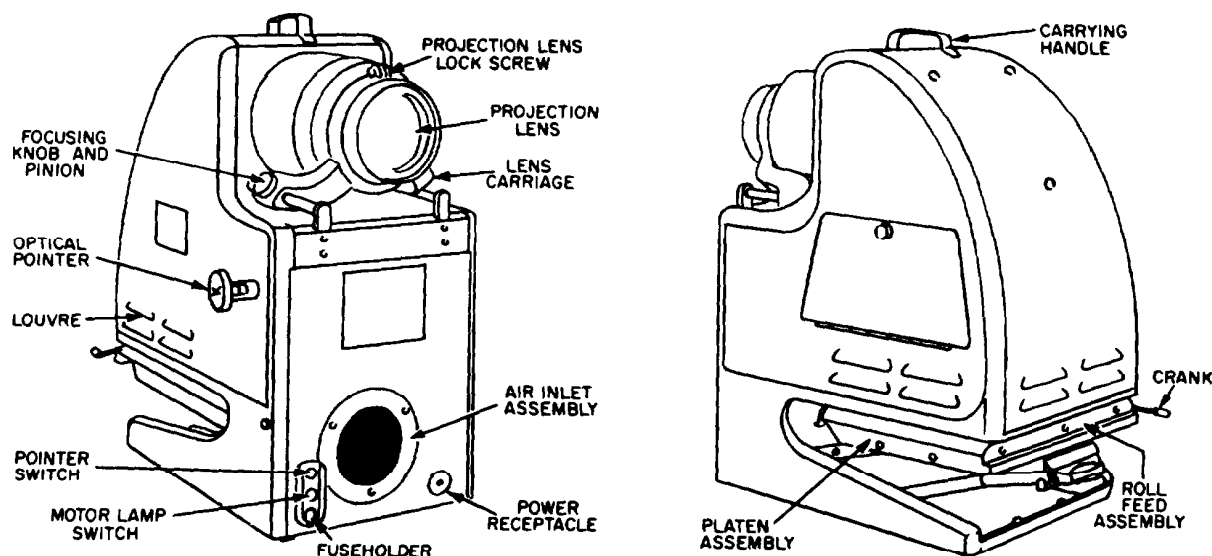


Figure 7-9.—Nomenclature for the opaque projector.

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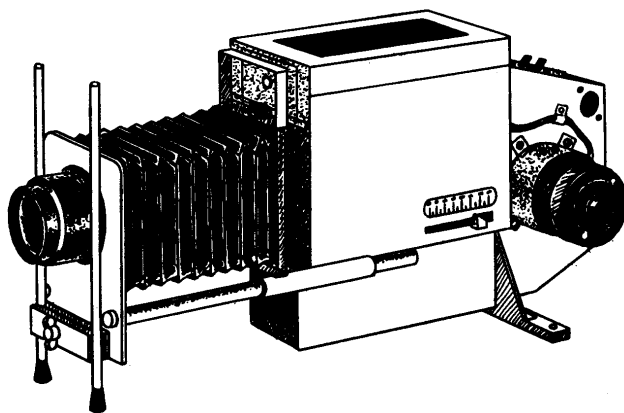
the heads of the audience. A low table which requires excessive extension of the elevating legs should not be used as this will produce a distorted screen image—it will be impossible to focus sharply. With the opaque projector, the screen illumination obtained is not great, and it is necessary to use a dark room for satisfactory projection.

### Lantern-Slide Projector

The lantern-slide projector is specifically designed for auditorium and theater projection of standard 3-1/4 by 4-inch lantern slides, 2-3/4 by 2-3/4 inch slides, and 2- by 2-inch slides. Some models of this type of projector have built-in optical pointers. The projector uses a 750-watt lamp, is blower cooled, and has an extremely wide range of objective lenses available. Figure 7-10 shows the standard lantern-slide projector.

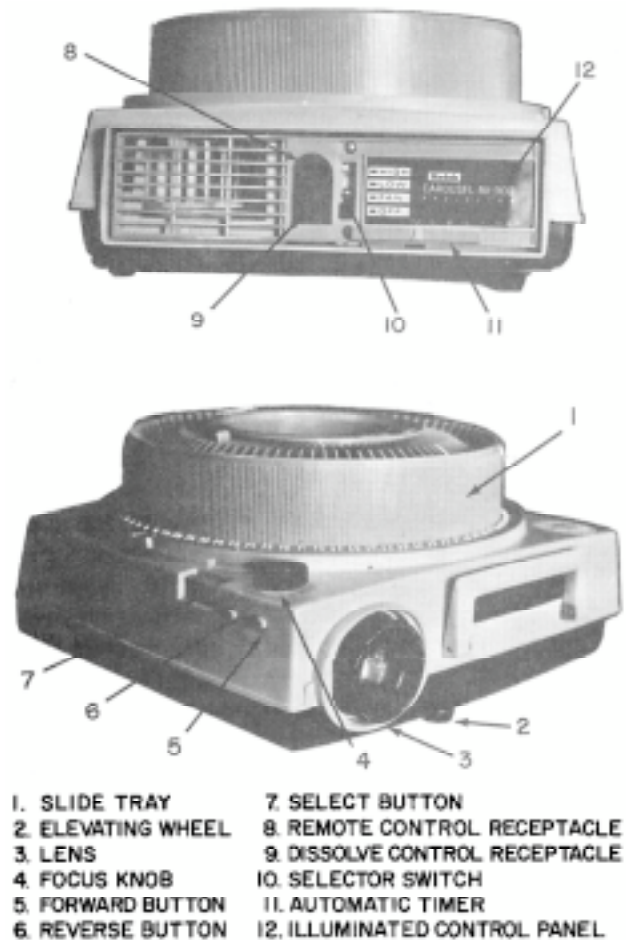
### Slide Projector

The Carousel projector (figure 7-11) is representative of the various types of slide projectors in use. This projector accepts any slide mount whether it is glass, cardboard, metal, or plastic as long as the outside dimensions do not exceed 2 inches by 2 inches (50 mm x 50 mm). The standard slide tray furnished with the



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Figure 7-10.—Lantern-slide projector.



- |                    |                                |
|--------------------|--------------------------------|
| 1. SLIDE TRAY      | 7. SELECT BUTTON               |
| 2. ELEVATING WHEEL | 8. REMOTE CONTROL RECEPTACLE   |
| 3. LENS            | 9. DISSOLVE CONTROL RECEPTACLE |
| 4. FOCUS KNOB      | 10. SELECTOR SWITCH            |
| 5. FORWARD BUTTON  | 11. AUTOMATIC TIMER            |
| 6. REVERSE BUTTON  | 12. ILLUMINATED CONTROL PANEL  |

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Figure 7-11.—Carousel slide projector.

projector accepts 80 slides with mounts up to one-tenth of an inch (2.5-mm) thickness and the optional universal slide tray accepts slides up to one-eighth of an inch (3-mm) thickness. Slide identification numbers are molded on the tray. A locking ring fits on top of the tray to keep the slides from spilling if the tray is inverted. The carrying case provides a means of carrying and storing the projector. This case also has two compartments that carry a slide tray, extension cords, lenses, and other miscellaneous equipment.

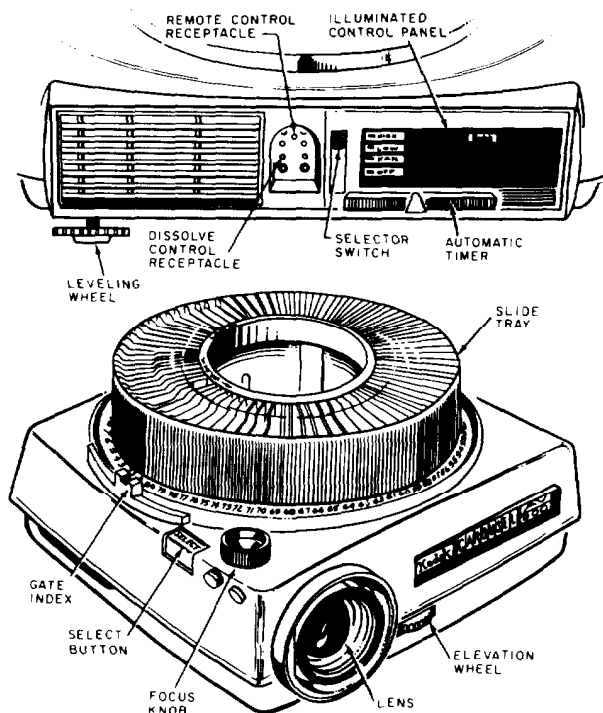
DESCRIPTION.—The Carousel projector is designed to ensure jamproof operation. When a

bent or broken slide catches in the gate, you can remove the locking ring on the slide tray, depress the select button, and remove the defective slide.

The round slide tray, accommodating 80 slides, is placed upright on top of the projector, as shown in figure 7-12. As the slide tray revolves, the number of the slide being shown appears opposite the gate index on the projector.

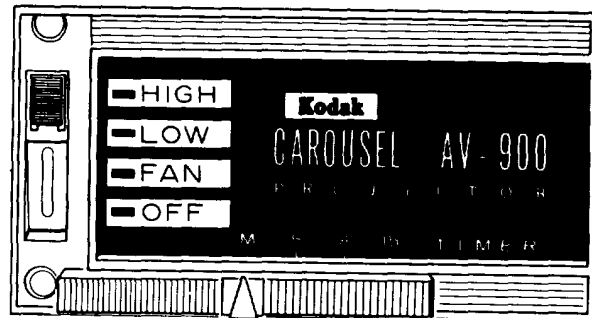
**CONTROLS.**—The operation and adjustment controls are shown in figures 7-12 and 7-13. The important operation and adjustment controls are given in the following subparagraphs.

a. The automatic timer has four settings: M (manual), 5, 8, and 15 seconds. The slide-changing mechanism is set in motion automatically when the automatic timer is set at the



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**Figure 7-12.—Carousel, Model AV-900 35-mm slide projector.**



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**Figure 7-13.—Control panel.**

5, 8, or 15 setting. Slides are shown on the screen for the number of seconds indicated by the automatic timer. Rapid advancement between slides eliminates long dark-screen periods.

b. The SELECT button (figure 7-12), lets you show (or sequence) single slides without the slide tray, show an individual slide out of sequence, or retrieve a slide from the gate. You also use this control when removing the slide tray.

c. The selector switch on the control panel (figures 7-12 and 7-13) may be placed at either of four positions. In the OFF position, the projector is completely turned off. In the FAN position, the fan operates with the projection lamp turned off. The HIGH and LOW positions provide a choice of brilliance for different projection conditions. (Longer lamp life is obtained when the LOW position is used.)

d. The elevation knob (figure 7-12) allows you to center the height of the projected image on the screen. The leveling wheel, located under one of the back corners, levels the projector.

e. The focusing knob (figure 7-12) allows you to focus the picture on the screen, as well as easily remove the lens.

**LENSES.**—The projection lens will give a brilliant, sharp picture under a wide range of conditions. There are 3-, 4-, 5-, and 7-inch lenses (8-, 10-, 13-, 18-cm), and a 4- to 6-inch zoom lens (10- to 15-cm). The zoom lens lets you vary the size of the projected image so that it fills the

screen without having to move either the projector or the screen.

**REMOTE CONTROL.**—A remote control unit is furnished with the projector. It consists of a remote control cord that plugs into the control receptacle at the back of the projector (figure 7-12). The 12-foot (3.7-m) remote control cord permits you to change slides with the simple push of a button. Forward and reverse selector buttons allow you to advance or reverse the slide tray. To advance the slide tray, depress the forward (FWD) button; to reverse the slide tray, depress the reverse (REV) button,

One or more 25-foot (7.6-m) cords can be added to the 12-foot (3.7-m) remote control cord. The focusing lever permits movement for away-from-the-projector focusing.

**PREPARATION.**—Place the projector, bottom side up, on a sturdy table, bench, or projection stand. Slide the storage compartment door latch in the direction of the arrow marked "OPEN" and raise the door. A three-wire, grounded, power cord is permanently attached to the projector. Remove the full length of the power cord. If a quantity of the cord is left in the compartment, it may interfere with the ventilation of the motor. Lay the power cord in the notch at the corner of the compartment and close the compartment door. Turn the projector upright.

The three-wire power cord and three-prong polarized plug are for direct connection to a 110- to 125-volt, 60-Hz, a.c. electrical outlet of the grounding type. By using a power cord adapter, it is possible to plug the projector into any conventional receptacle. However, when this is done, the grounding wire on the adapter should be connected to a suitable ground. In locations where the projector will be used frequently, the usual two-prong receptacle should be replaced with a three-prong polarized receptacle that is properly grounded.

Position the carrying handle as far up as it will go, so that it will not interfere with access to the elevation wheel. Plug the remote control cord into the remote control receptacle at the back of the projector.

**SCREEN AND SEATS.**—Since most slides are horizontal, it is most convenient to use a square screen. The screen should be large for easy viewing. Position the screen at the same level as (or higher than) the projector.

**LOADING THE SLIDE TRAY.**—Check to be sure that the lock on the bottom of the tray is engaged in the notch in the metal slide retainer. If it is not, turn the retainer until the lock engages the notch. Remove the locking ring from the top of the tray. Invert each slide and place one in each open slot so that the printed border or trademark side of cardboard-mounted slides (or the emulsion side of a glass, metal, or plastic-mounted slide) face toward the next lower number on the slide tray. For example, the emulsion side of slide number 2 should face toward slide number 1 and so on. After loading the slide tray, replace the locking ring, turning it in the direction of the arrow marked "LOCKED" until the detented action can be felt at least once or twice and the ring is secure on the tray.

**SEATING THE LOADED SLIDE TRAY.**—Place the loaded slide tray on the projector so that the hole in the center of the tray fits over the center post on the top of the projector. Then, revolve the slide tray slowly until the identification number "0" is opposite the gate index on the projector (figure 7-12). After pushing the tray down into the operating position on top of the projector, check to be sure that the lock on the bottom of the tray is engaged in the notch in the metal slide retainer. If it is not engaged, turn the retainer until it engages.

**OPERATION.**—When you have placed the projector on a sturdy table, properly plugged in the power cord, positioned the screen and chairs, inserted the slides into the tray, and seated the tray, you are ready to begin the operation of the projector.

**Projection Lamp.**—After setting the automatic timer to the M (manual) position, you can turn on the projection lamp by sliding the select or switch to either the LOW or HIGH position. Momentarily depress the FORWARD

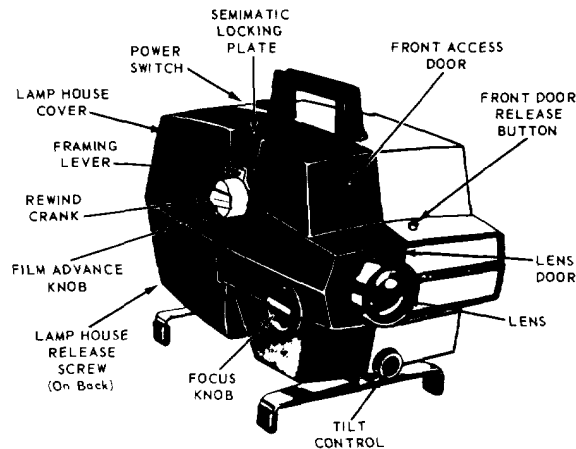
button on the remote control to put the first slide into viewing position.

**Center and Focus.**—Center and focus the projected image on the screen. Do so by turning the elevation wheel to elevate the projector to the desired position. Level the projector, if necessary, to align the image on the screen. Obtain a sharp focus by rotating the focus knob back and forth to focus the picture on the screen. You may also focus the picture on the screen by using the focus level on the remote control.

**Automatic Timer.**—Set the timer for the type of presentation. For example, if the projector is part of a display, the automatic timer can be used to advance the slides; but the manual setting is better if a speaker is present or if an AV assistant is available to help in the briefing.

**Long-run Applications.**—Allow for unrestricted flow of air to the projector openings. If the projector is used in a window display or in a cabinet, be sure to provide an adequate outlet for the warm air expelled from the rear grill vent. In some applications, additional ventilation may be needed. The air circulating through the projector should be as dust-free as possible. Ample cooling results if cool air is available to the projector. Normal room temperatures are adequate.

**Emergency Slide Tray Removal.**—If the slide-changing mechanism should become inoperative because of a defective slide or some foreign object, switch the automatic timer to M (manual). Turn the slotted tray removal screw in either direction, as far as it will go, to retract the tray lock. While holding the screw in this position, lift off the slide tray. Because the slide tray has been removed in this manner, the lock on the bottom of the tray is no longer engaged by the notch in the metal slide retainer. With the tray placed upside down, turn the retainer until the lock engages the notch in the retainer; then remove the defective slide from the projector by pushing the SELECT button. Replace the tray on the projector.



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Figure 7-14.—Filmstrip projector.

### Filmstrip Projector

The filmstrip projector shown in figure 7-14 is the Bell and Howell Autoload, Model 745A. The function and operation of this projector is similar to that of the many different types of filmstrip projectors currently in use in audio-visual facilities.

The model 745A filmstrip projector accepts standard 35-mm filmstrips and adapts to 2- x 2-inch (50- x 50-mm) slides. Here we are concerned with its function as a filmstrip projector. Figure 7-14 illustrates the important parts of this projector.

**SETTING UP THE PROJECTOR.**—Place the projector on a firm stand or table. Slide the front lens door open. Attach the power cable to a proper outlet and be sure the ground cable is attached to the outlet.

**LOADING THE CARTRIDGE AND PROJECTOR.**—Grasp the filmstrip by the end and tighten the film into about a 1-inch (2.54-cm) diameter roll. Open the door of the cartridge, and position the film so that the leading edge feeds through the top opening of the cartridge.

To load the projector, open the lens door by pressing the release button on the front of the projector. Pull open the access door. Pull the hinged cartridge lock down and away from the



cartridge holder and slide the cartridge into position. You can project the filmstrip without the cartridge by placing the filmstrip roll in the cartridge holder with the leading edge of the film feeding from the top. Replace the cartridge lock and close the front access door. You are now ready for focusing, framing, and advancing the film.

**OPERATION.**—The projector power switch is on the top of the projector directly behind the carrying handle. It is a three-way switch operating the fan in the COOL position and both the fan and the lamp in the LAMP position. Turn the film advance knob counterclockwise until an image appears on the screen. Adjust the focus until the image is sharp. Frame the image by moving the framing level to either side until the full image is on the screen.

You must center and level the image. This projector has a tilt knob which adjusts the elevation of the image. Raise or lower the projector by turning the knob counterclockwise. This releases the spring-tensioned foot. Lock this foot by turning the knob clockwise. Level the projector by applying downward pressure to either of its sides. The projector is now set up.

After completion of the presentation, rewind the filmstrip by the rewind crank. Open the rewind crank from the film advance knob.

**CLEANING AND MAINTENANCE.**—Preventive maintenance is the best way to keep any piece of AV equipment in top operating condition. To clean the optics of the projectors, open the lamp house cover, after first disconnecting the power cord. Remove the lamp house by loosening the release screw on the lamp house cover. The various condensers and heat filters are held in place by a spring clip which, in turn, is held in place by a screw. After loosening the screws, lift out the spring clip. Remove the optics and clean them with a lint-free cloth, moistened with lens cleaner. Reverse the removal process to replace the optics in the projector. Clean the lens in the same manner that you clean the other optics. The film track and pressure plate should be wiped with a clean, lint-free cloth moistened with acetone or alcohol. These solvents are very good for removing dirt and emulsion from the film path.

## **MOTION PICTURE PROJECTORS**

As a Religious Program Specialist, you will normally be required to operate motion picture projectors. A projectionist is a key member of a presentation team responsible for the operation, cleanliness, and routine maintenance of the audiovisual equipment, and the general appearance of the presentation room. Whether an audience profits from a presentation depends, to a large extent, on you. In order to assure a professional presentation, you must maintain high standards at all times because you control the projection and sound reproduction equipment. You should also refer to ART 1410440, MILPERSMAN, which states how you may become designated as a motion picture operator. Programmed courses of instruction are available which can provide the information necessary to become a qualified 16-mm projector operator, which will satisfy, in part, the requirements of ART 1410440, MILPERSMAN. These courses may be obtained through your Educational Services Office.

### **Principles of the Motion Picture**

The motion picture is, in reality, a series of still pictures, projected successively at such a rate of speed that it gives the illusion of motion. When the eye is permitted to see an object for an instant after which the object is removed and obscured, the eye will continue to see an image of the object for approximately one-fortieth of a second thereafter. This is called the persistence of vision. If a series of still pictures is projected, in which the same object is seen in a slightly different position in each picture, the eye will merge the sequence into one continuous motion. The purpose of a motion picture projector is to project a sequence of images upon a screen. However, the projector not only projects the pictures on the screen, but it synchronizes sound with the picture.

### **16-mm Motion Picture Projector**

The most common size of film produced and employed by the Navy for motion pictures is the

16-mm film. The 16-mm films are used extensively for training, briefings, and entertaining personnel.

The 16-mm motion picture projectors can be operated virtually anywhere that 105-125V (50-60Hz) alternating current is available. Most of these projectors will project silent or sound motion pictures. There are some projectors however, that project either silent or sound but not both.

Most projectors are equipped with built-in sound systems capable of working with or without separate amplification equipment. Usually, a speaker is supplied with the projector. In many models the amplifier-loudspeaker components are mounted in the projector case.

### **Principles of Operation**

The operation of the various makes and models of motion picture projectors is very similar. Read the instruction manual for each different projector before operating that particular equipment.

**SETTING UP THE PROJECTOR.**—When using a portable screen, set it up relative to the audience size. Position the projector stand or sturdy table at the approximate correct distance from the screen. Place the projector on the stand. It must be high enough so that the projected light will be above the heads of the audience to prevent shadows on the screen. Connect the power cord to a three-prong outlet. If the presentation is with sound, turn on the volume control to warm up the amplifier tubes. (NOTE: All transistor amplifiers require very little warmup.)

Most reel arms are permanently mounted to the projector requiring only that you raise and lock them into place. In older models however, the reel arms must be assembled; if so, remove them from the carrying case and secure them to the projector.

Place the reel holding the film on the front arm and an empty reel on the rear arm.

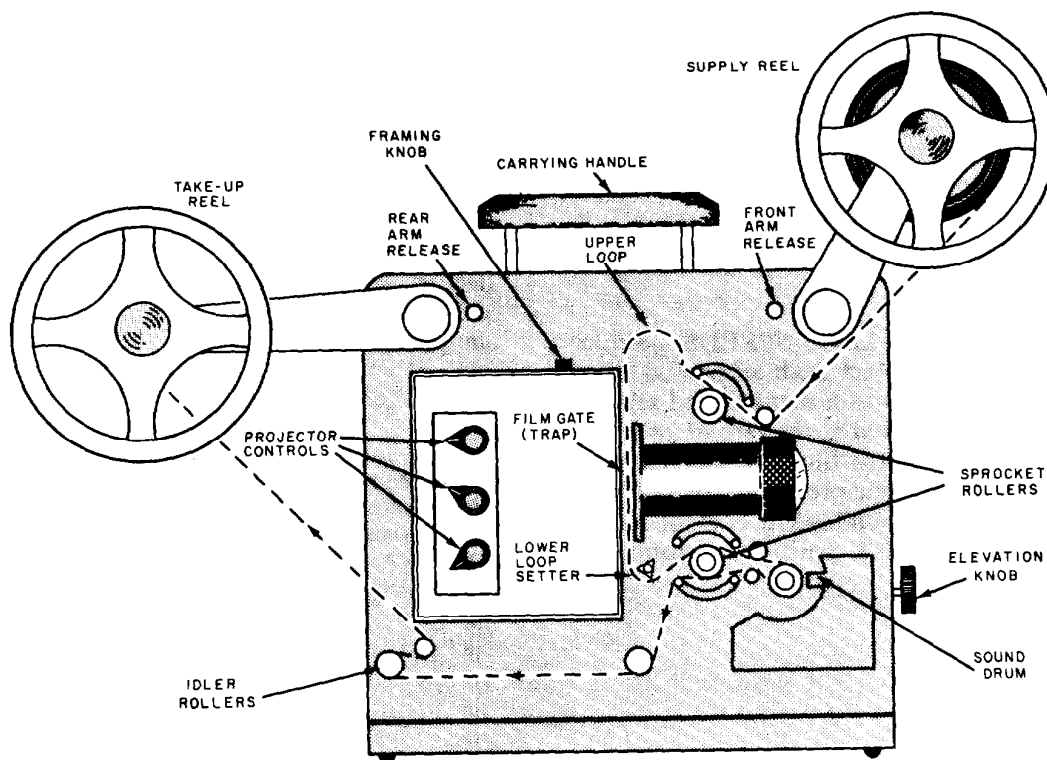
Figure 7-15 is a side view of a manual threading projector and is typical of many projectors in use. Study this figure to become

familiar with the important parts of the projector.

**MANUAL THREADING.**—Most projectors have a threading diagram displayed somewhere on the projector body. Find detailed threading instructions in the manufacturer's instruction manual for the particular make and model projector you are using. Be sure that the sprocket holes are engaged with the sprocket teeth. It is also important that you form proper sized loops above and below the film gate. The upper loop permits intermittent movement of the film. The lower loop prevents this irregular motion of the upper loop from affecting the smooth feeding of film through the sound head.

**AUTOMATIC THREADING.**—Automatic threading greatly simplifies your task of preparing for a presentation. The following steps are used to thread a projector with the automatic threading feature: First, ensure that the end of the film leader is squarely cut. Move the threading control lever to the load position. Insert the end of the leader into the input channel, engaging it with the upper sprocket. Switch the projector to run. The projector will thread automatically. When the leader exists at the rear of the projector, turn the projector off. Tug gently on the end of the leader. This action releases the automatic threading mechanism. Wrap the film to the takeup reel. This completes the threading operation.

**STILL PICTURES.**—Some projectors are designed to stop on individual frames, permitting them to be shown as still pictures. To show a single frame, rotate the still picture control to STILL or depress the STILL button, whichever is appropriate for the specific projector. Frequently you must refocus to bring out a sharp still picture. A heat shield will automatically drop into position protecting the film from heat damage. This shield blocks off much of the light and dims the picture. (Full intensity of light from the projector lamp would heat the film to its melting point in just a few seconds.) Turning the control switch to STILL or depressing the STILL button removes power from the the drive motor, stopping the main drive shaft. The heat shield is then pulled into the optical path by the return spring.



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Figure 7-15.—16-mm threading diagram.

**REWINDING.**—After you have completed your showing and all the film is on the takeup reel, turn the motor-lamp switch to the OFF position. The film should be rewound onto the front reel and made ready for showing again. NOTE: The lamp should have been turned off when the trailer started through the machine to prevent blinding the audience by the white screen and to allow the lamp to cool a bit before the motor and fan are stopped.

Listed below are the five steps for rewinding most projectors. With the motor-lamp switch in the OFF position, do the following:

(1) Support the full reel with your left hand and lift up slightly. Press the takeup reel arm release button and swing the reel arm to the vertical REWIND position.

(2) Attach the end of the film to the underside of the front reel. Rotate the front reel counterclockwise by hand for two turns to secure the end of the film to the reel.

(3) Move the appropriate switch to the REVERSE or REWIND position, and the film will begin to rewind.

(4) Press and momentarily hold down the REWIND button to speed up the rewind process.

(5) Turn the switch to OFF as soon as the film is fully rewound. The film is then ready for storage or for a second showing.

In most of the newer models, the film is rewound directly from the takeup reel to the supply reel. This may be brought about by

changing the operation of the film feed clutch assembly while the drive system is operated in reverse. Some of the older models require that the reels be exchanged on the arms for re-winding. That is, the film on the takeup reel is placed on the supply arm and the empty supply reel is moved to the takeup arm. Check the instructional manual for the projector with which you are working to determine the steps for rewinding film on that specific projector.

**SOUND AND SILENT SPEEDS.**—Projectors designed to project both silent and sound films are equipped with a silent/sound selector. Sound film is projected at the rate of 24 frames per second (fps). Silent film is projected at the speed of 16 fps in some projectors and 18 fps in others. When the sound/silent control lever is placed in the SILENT position, it rotates an

eccentric\* that is attached to it, approximately 180°. This slows down the speed of the film. When the sound/silent control lever is in the SOUND position, normal conditions are restored and the film moves at the speed of 24 frames per second.

**PROJECTION OPTICAL SYSTEM.**—The projection optical system, shown in figure 7-16, consists of the projection lamp, a reflector, condensing lens assembly, projection lens, a blower motor and cooling ducts, and shutters.

\* Eccentric: A mechanical device consisting of a disk through which a shaft is keyed eccentrically and a circular strap which works freely round the rim of the disk for communicating its motion to one end of a rod. The other end is constrained to move in a straight line so as to produce a reciprocating motion.

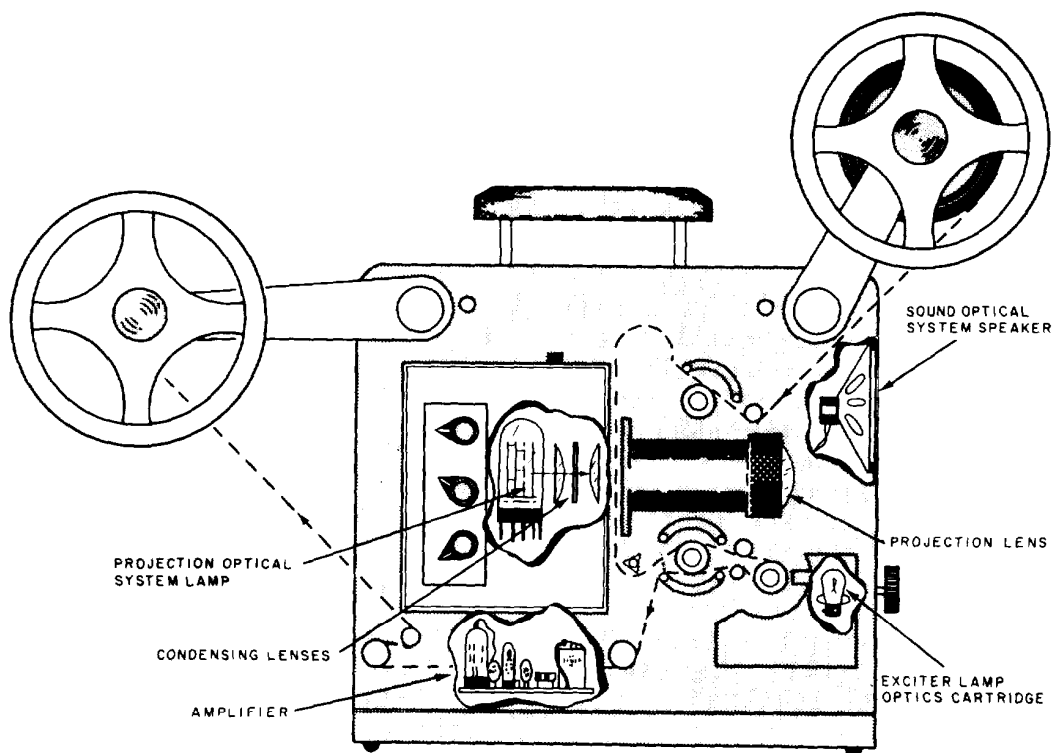


Figure 7-16.—Projection and sound optical system.

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**PROJECTION LAMPS.**—Projection lamps must have a voltage rating equal to the line voltage. The lamp is usually installed in a lamp house designed to accommodate either a 750- or 1,000-watt projection lamp. Most projectors are designed to prevent the installation of the lamp in an incorrect way. They may have a small pin or slotted flanges in the projection lamp base which permits the insertion of the lamp in only one way.

In many models a glass reflector is positioned precisely behind the projection lamp. Since an equal amount of light is distributed in a direction opposite to that of the condenser lens system, the reflector is used to return as much of this light as possible to the condenser lens.

The Graflex 16 projector uses a type of lamp which eliminates the need for reflectors. A built-in dichroic reflector reflects visible light forward through the optical system but allows the heat-producing infrared rays to pass through it to the rear of the projector. The lamp is a low power consumption 21-1/2 volt, 250-watt lamp; yet with the built-in dichroic reflector it is able to provide screen brightness equivalent to a high-voltage 1,200-watt lamp. This projector has a lamp transformer built into allow matching with local voltage variation for optimum lamp performance and life. So, if you are operating the Graflex projector, the machine will not have the standard projection lamp reflector described in the preceding paragraph.

The condensing lens assembly contains two lenses. These lenses pick up the light from the lamp and concentrate it into an intense beam. This beam of light is directed through the aperture across which the film travels. As the light passes through the film, it produces an image which is carried along the beam of light to the projection lens.

The projection lens picks up and projects the image brought to it by the beam of light. To meet average conditions, most projectors are supplied with a lens that has a 2-inch (50-mm) focal length. Other focal length lenses are available for projecting various sized pictures and for projecting at various projector-to-screen distances. Some projectors are also equipped to accept a field flattener for maximum corner-to-corner sharpness or a zoom lens with which you can enlarge the picture.

Projector lamps are blower-cooled. In most projectors the blower fan is in operation at all times when the projector is turned on, even though the projection lamp is not lighted. Cooling air is brought in and forced around the projection lamp and out through the lamp house top cover. The cooling air carries the heat away from the lamp. Usually the arrangement of the lamp and motor switches is such that it is impossible for the lamp to light unless the cooling system is in operation.

**SOUND OPTICAL SYSTEM.**—(See figure 7-16.) The sound track on the film must pass around the sound drum (figure 7-1 5) at a constant rate of speed if good quality sound reproduction is to be obtained. Usually the sound drum shaft is stabilized by means of a flywheel to give it the constant speed necessary. The sprockets, immediately before and after the sound drum, control the path of travel of the film over the sound drum. As the film is driven through the projector, the sound track portion of the film passes between the sound optics cartridge and the photocell. The sound optics cartridge shapes and focuses the light from the exciter lamp into a rectangular beam, which passes through the sound track into the photocell. Variations in the sound track image density or area cause corresponding fluctuations in the amount of light transmitted to the photocell and result in voltage changes which are applied to the amplifier.

The light for the sound track scanning beam originates in the exciter lamp. It is beamed by the optical parts in the sound optic tube which focuses the light in the shape of a narrow slit on the sound track of the film. After passing through the sound track, the light impulses are reflected by a small mirror located behind the sound drum to the photoelectric cell, where they are converted into electrical impulses. The electrical impulses are then sent to the amplifier, where they are amplified. The loudspeaker converts the impulses into sound.

### **Care and Maintenance**

Each operator of a 16-mm projector should be able to perform simple maintenance. You should at least be able to clean the film path and

replace lamps. These tasks are extremely important for continued operating efficiency.

There is a tendency for film emulsion to rub off the film and build up at certain places in the film path. Caked emulsion or burrs can cause loop loss due to nonclosing of sprocket shoe locks. Other problem areas are excessive film slap which is due to a dirty gate; jammed film splices in sprocket shoes; clicking noises and fading high frequencies which are due to dirty sound drums; and the sticking, ejection, or pileup of film in the takeup sprocket shoe areas. Cakes or burrs on film guides, shoes, aperture, or pressure plates often cause film scratches. These are a few of the troubles that could result. Any obstruction in the film path can be expected to interfere with proper transportation of the film. You will save time by cleaning the film path and, at the same time, make an inspection of lenses and lamps after each reel is shown.

**FILM PATHS.**—All film path areas must be kept free from emulsion buildup or other foreign materials. Never use metal tools to remove material adhering to guides, rollers, or sprocket shoes. Metal tools could do damage to some of the parts. Use an orange stick, a plastic rod, or a toothpick whenever scraping is necessary. Soft, lint-free cloth, lens tissue, or a pipe cleaner, dampened with acetone, naphtha, or isopropyl alcohol are very convenient for removing emulsion from the film path and for cleaning in restricted areas. Trichlorethylene or carbon tetrachloride should NOT be used as cleaning solvents because they might stain or damage plastic parts. They are also toxic. Wipe all threading guides (if the projector is designed for automatic threading) with a soft, lint-free cloth or a brush moistened with any naphtha-base solvent. Film jump could result from a dirty film gate; therefore, the gate should be wiped clean. A dirty aperture may cause poor focus; so clean the aperture plate and the pressure plate with an aperture brush or with a soft, damp, lint-free cloth. Clean the aperture side tension rails and the aperture opening. Be sure that all caked emulsion and lint are removed. Do not remove the aperture plate for daily cleaning because a special tool is required to realign the plate. Clean and inspect all film sprocket shoes and rollers. Use a soft, damp cloth to clean the

surface of the sound drum that contacts the film.

**CLEANING THE LENSES.**—Clean the lenses if the projector is used daily. The lenses of the 16-mm projector can be removed for cleaning without too much difficulty. Follow the instructions for removal and replacement of the lenses published in the appropriate instructional manual or technical order.

Clean the external glass surfaces of the projection lens and examine them for cracks, scratches, or chipping. The projection lens of some models may be removed by loosening a lens lock screw and removing the lens. On others, the projection lens may be removed by threading the lens out as far as it will go, turning the focus knob in a counterclockwise direction, and then lifting the lens out. Clean the exposed surfaces of the lens elements by wiping them gently with lens tissue. If wiping the lenses with lens tissue does not clean them, apply a drop of lens cleaner to the lens tissue. Then wipe the lens surfaces gently with the damp lens tissue. Do not apply lens cleaner directly to lens elements because it may eventually cause the lens coating to come off. Insert the cleaned lens into the carriage and reposition it by turning the focusing knob clockwise to engage the lens or by inserting the lens into the lens mount and locking the lens lock screw.

To clean the reflector and the condensing lenses, you must be familiar with the projector. Some of the newer models have the reflector built into the lamp. Some are so constructed that the condensing lenses should not be removed from their carriage. With some models, you can get to the reflector and condensing lens assembly by opening the lamp house and lifting out the projection lamp. The condensing lens assembly can be lifted out. With the condensing lenses removed, you can clean the reflector with lens cleaning tissue. If grease has accumulated on the reflector, remove it by first wiping it with a soft, lint-free cloth dampened with lens cleaner; then wipe it with cleaning tissue. Clean the two outside surfaces of the condenser lenses in the same way and then reassemble the reflector and lenses. With some models, when the lamp house cover is removed, the carriage for the condenser lenses can be rotated down and out of the

housing. Clean the outside surfaces of the lenses as described above and then replace the carriage.

**PROJECTION LAMP REPLACEMENT.**—To replace the projection lamp, turn off the projector and disconnect the power cord. Allow the upper portion of the lamp house to cool before handling it. Remove the lamp house cover. If the projector has a lamp ejector lever, lift the lever gently to release the lamp from the socket. Remove the lamp by hand. If the lamp is hot, use a glove or cloth. The base of a projection lamp is designed with either flanges or prongs to hold it in position. To remove lamps equipped with flanges, press the lamp down firmly, turn it counterclockwise 90°, and lift it out. For the lamps equipped with prongs, pull the lamp straight out.

Replace the burned-out lamp with a lamp of the same wattage and type. Remember to have a spare bulb available.

To install a new projection lamp with flanges, line up the wide and narrow flanges on the base of the lamp with the corresponding lamp socket slots and insert the lamp with the socket. Press the lamp down firmly and turn in a clockwise direction until it locks in place. To install a projection lamp with prongs, set the new lamp into the socket and rotate it slowly until the prongs settle into the proper receptacles. The lamp will fit only one way.

Try not to get fingerprints on the projection lamp, but if there are any prints on the lamp, wipe them off. Fingerprints on the lamp reduce the light output and cause the bulb to get too hot in the area of the fingerprint. This causes this area to expand and may possibly cause the lamp to shatter.

After installing a new lamp, always project the light on the screen and focus the image of the aperture. If the light distribution is uneven, adjust the position of the lamp as directed by the operation manual or technical order for the specific projector.

When the appropriate projection lamp has been installed, reassemble the lamp house cover.

**EXCITER LAMP.**—Generally, the exciter lamp cover and the exciter lamp can be easily removed and replaced without the use of tools. The exciter lamp cover acts as a dampening

shield which covers the exciter completely except on the side facing the sound lens. This cover eliminates stray reflection within the exciter lamp chamber and prevents any light, other than the direct beam from the exciter lamp, from entering the sound optical system.

To remove and replace the exciter lamp, first turn the volume control switch to the OFF position. Disconnect the power to the projector. Then remove the exciter lamp cover by loosening the thumbscrew until the cover can be lifted from the projector. Note the location of the registration pins that align the cover, as these must be repositioned precisely to replace the cover. Move the exciter lamp release and locking lever to its extreme right-hand position. This releases the registration pins and permits the lamp to be lifted from the socket. Clean the exciter lamp with a clean cloth or lens tissue. Avoid leaving fingerprints.

The sound lens is partially exposed when the exciter lamp cover is off. Clean the sound lens, with one face exposed toward the exciter lamp and the other face exposed toward the sound drum, by blowing air across the external surfaces of the lamp with a syringe bulb. Remove any remaining dust or dirt with a camel's-hair brush; then use a lens tissue to wipe the lens surface clean. Do not attempt to move the sound lens from the projector or disturb the setting of the lens. Clean the external surfaces of the lens.

When installing a new exciter lamp, place the lamp base openings over the appropriate registration pins and turn the exciter lamp release and locking ring to the extreme left-hand position. This will seat the lamp firmly in place. Wipe the exciter lamp with a clean cloth or with lens cleaning tissue to remove fingerprints. The exciter lamp is prefocused and no adjustment of this lamp or its socket is required.

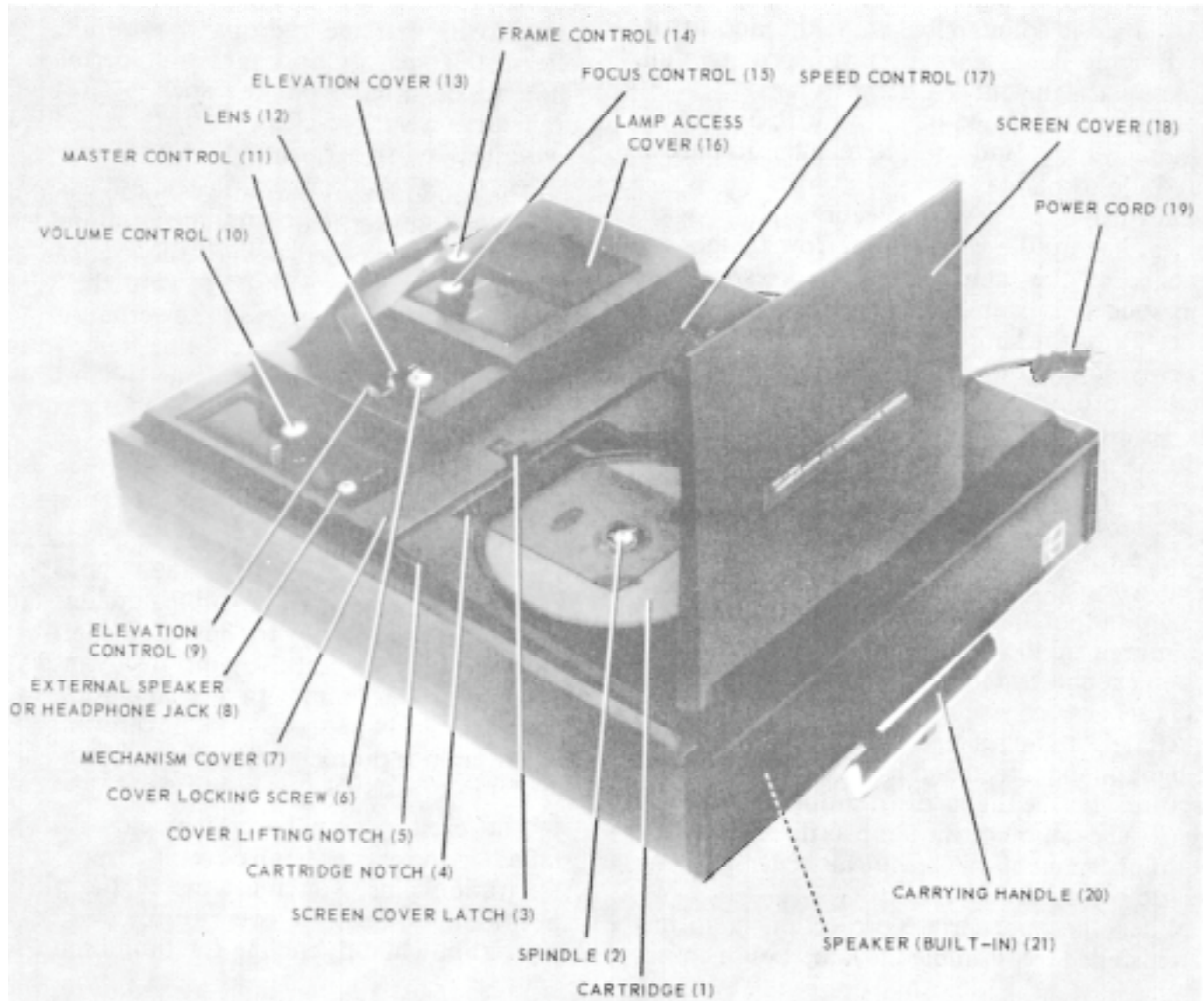
The exciter lamp cover may now be reinstalled. If the exciter lamp cover is designed with registration pins, you must match the pins to specific holes. Seat the cover firmly and hold it in position while tightening the thumbscrew.

**DRIVE BELTS.**—Most projectors are designed to use two drive belts. A takeup belt drives the takeup reel during projection, a rewind belt rotates the film reel on the feed reel

arm during the rewinding operation. Generally, a projector has either spring belts or fabric belts. The type is determined by the make and model.

The belts must be inspected for cleanliness and kinks. The belts should be cleaned with a naphtha-base solvent. Any kinks in the belts must be taken out. Consult the operation instruction manual for the specific make and model of the projector for methods of removing and installing the belts and for regulating the tension applied to the belts.

**FUSE REPLACEMENT.**—Make certain that the projector power cable had been disconnected from the power source before you attempt to remove a projector fuse. Some projectors have two fuses, the power fuse, and the amplifier fuse. To remove a fuse, follow published instructions for the specific projector. Usually, a fuse may be removed by unscrewing the fuse post with a screwdriver or by turning the fuse cap slightly in a counterclockwise direction with a screwdriver and then pulling the fuse out.



**Figure 7-17.—8-mm cartridge projector.**

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To reinstall the fuse, follow the reverse operation. Never replace a fuse with one of a different rating from that of the fuse supplied with the projector.

There are no fuses in some of the current projectors. In these models, the amplifier circuit is protected with a resistor that will burn out only in case of component failure. The resistor protects the amplifier from further damage. If the resistor burns out, this is an indication that the amplifier should be checked thoroughly.

The preceding sections gave you some of the simple maintenance information that, as a projector operator, you should know and be able to apply. Perhaps there are other simple maintenance operations that you will perform. When more complicated maintenance is required, return the equipment to the place of issue and, if possible, exchange it for serviceable equipment. If your command has the capability to overhaul the equipment, turn it in to your own repair section. When your command lacks a maintenance capability, turn the AV equipment in to the base AV library, or to a contract maintenance organization.

### 8-mm Motion Picture Projector

In our discussion of motion picture projectors, we have already covered a 16-mm projector representative of the many types currently in use. Here we cover the 8-mm projector. It is also representative of the many varieties of cartridge projectors, both 16-mm and 8-mm, that are in use today.

**CHARACTERISTICS OF THE 8-MM PROJECTOR.**—The cartridge 8-mm motion picture projector provides fully automatic projection of super 8-mm sound or silent film. The projector featured in our discussion is illustrated in figure 7-17 with its important parts noted. This projector is the Kodak Supermatic 60, manufactured by the Eastman Kodak Company. The projector weighs 29 pounds (13 kg) and is capable of projecting super 8-mm film in cartridges ranging in size from 50 feet (15 m) to 400 feet (122 m). The projector projects films at one of two speeds, 18 frames per second (fps) for silent films or 24 fps for sound films. It contains

an all transistorized amplifier and utilizes a magnetic playback head to reproduce the sound from 8-mm film equipped with a magnetically stripped sound track. The projector has a built-in screen for individual viewing or may be utilized with an external screen for group viewing. Whereas most cartridge projectors use continuous loop films, this model is equipped for automatic threading and rewinding. Any super 8-mm film may be loaded directly from the reel into one of the four available cartridges.

**SETTING UP THE PROJECTOR.**—To set up this 8-mm projector, you first set it upright on a firm table or stand and unwind the power cord. It has a three-pronged plug which is inserted in a 110- to 120-volt 60-Hz, alternating-current outlet. Set the projector in a horizontal position with the controls toward you.

Pull back on the screen cover latch, figure 7-17(3), and raise the screen cover (18). Push the spindle (2) to the right and move it into the correct position for the cartridge you are to project. In some cartridge projectors the cartridge is simply inserted into the slot provided in much the same manner as you would insert a cartridge tape into a tape player. Seat the cartridge on the spindle and close the screen cover if you are using an external screen. The lens provided with the projector gives a 6- x 8-inch (15-cm x 20-cm) image on the built-in screen and is not recommended for use with an external screen. Consult the lens, distance, and screen chart for the proper screen and lens. This chart is provided with each projector.

After raising the elevation cover, figure 7-17(13), follow the slot with the master control, shown in figure 7-18, from OFF to STILL. Center the projected image on the screen by

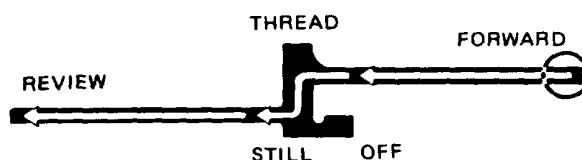


Figure 7-18.—Master control.

moving the elevation control, figure 7-17(9). For an external screen, the image can be centered horizontally by moving the entire projector from side to side.

Adjust the speed control, (17) in figure 7-17, to the correct speed for the film to be projected, 18 or 24 fps. Be sure the projector is running when this adjustment is made. You are now ready to thread the film.

Threading is extremely simple with this projector. Follow the slot with the master control from OFF to STILL, pause momentarily, then move the master control along the slot into THREAD and to FORWARD.

**FORWARD OPERATION.**—When the self-contained screen is used, the room does not have to be darkened. Projection is possible in a normally lighted room. However, if an external screen is used, be sure to check the light level in the presentation room. Focus the image by rotating the focus control, figure 7-17(15), and frame the image with the frame control (14). Adjust the volume level to a comfortable listening level with the volume control (10). If a silent film is being projected, turn the volume control all the way counterclockwise to eliminate any possible background noise.

**STILL.**—This projector is equipped to show single frames, if desired. Move the master control from FORWARD to STILL. You may move the film a short distance by moving the master control approximately halfway from STILL to FORWARD and back to STILL,

**FILM REVIEW.**—To review a portion of film that has already been projected, move the master control from FORWARD to REVIEW. When you reach the portion of film you wish to review, move the master control back to STILL, and then to FORWARD to resume projection.

**REWIND PROCEDURE.**—This projector is equipped with an automatic rewind mechanism. This mechanism operates when the entire length of film has been projected. You are, however, able to rewind the film before it has been projected by following the procedures for reviewing.

After the film has been rewound into the cartridge, move the master control to REVIEW to check the image, if nothing but light appears on the screen, then the film is totally rewound. Move the master control to OFF, remove the cartridge, and prepare the projector for storage.

**CARE AND MAINTENANCE.**—The 8-mm projector, like all other AV equipment, requires preventive maintenance to ensure a long, useful life of the projector for your AV facility. The projection lamp, lens, and mirrors require careful handling to prevent damage. For example, the projection lamp will burn out if the projector is subjected to rough treatment while in operation.

The lens must be kept clean since fingerprint smudges and a heavy coating of dust will reduce the image brightness and clarity. Consult the technical order or the manufacturer's manual for specific instructions on how to accomplish this or any other specific maintenance procedures.

There are two mirrors on this projector which deserve special consideration and care. They are front-surface mirrors. That is, the reflective surface is on the front of the glass. A front-surface mirror does not reduce image brightness or clarity which is a problem of conventional mirrors; however, even a small amount of dust or a fingerprint smudge can affect the brightness of the image. Small scratches do not affect the brightness of the image even though they may be visible when you look directly at the mirror.

These front-surface mirrors are cleaned with an approved lens cleaner and lens tissue. When maintenance is being performed on the projector, cover the mirror in front of the lens with a soft tissue to prevent damage.

## **AUDIO EQUIPMENT**

As a Religious Program Specialist, you will operate not only projection equipment but also audio equipment. This equipment ranges from public address systems to audio tape recorders. You will come into contact with this type of

equipment primarily in an audiovisual presentation. You will be responsible for selecting, setting up, and operating this equipment in a variety of situations. These could range from auditoriums and conference rooms to classrooms and offices. This section presents information on the components of an audio system and a representative type of audio recorder. You will gain practical experience as you perform your duties.

## **AUDIO SYSTEM COMPONENTS**

Before you can effectively operate any type of audio equipment, you must understand the basic principles and the individual components that go into an audio system. These individual components will be discussed first. They are (1) microphones, (2) amplifiers, and (3) loudspeakers.

### **Microphones**

The function of a microphone is to change sound (mechanical) energy into electrical energy which then is passed on to the amplifier. The variations in sound waves are converted into corresponding electrical variations. Since the development of the first crude telephone transmitter or microphone by Bell in 1875, many types of microphones have been invented but most have been discarded and now only a few are used to any extent. In a microphone two things are important: sensitivity and fidelity. Sensitivity is the degree of electrical variation for a given intensity of sound wave. Fidelity is the ability to reproduce the audiofrequencies in their proper relative magnitude without generating other frequencies in the process. In most of your work, the second requirement is more important because the microphone is primarily used so much in narrations. You should use a microphone that can reproduce the audiofrequencies and get high-quality sound. If the sensitivity is low, the electrical output can be increased by using additional amplifiers.

**MICROPHONE TYPES.**—Two types of microphones are in current use in most facilities. They are the crystal and the dynamic.

**Crystal.**—The crystal microphone is of medium sensitivity and gives good fidelity at speech frequencies. It is widely used in public address work and radio other than broadcasting.

**Dynamic.**—The dynamic microphone consists of a coil attached to a diaphragm which holds the coil suspended in the field of a cobalt permanent magnet. The speech waves cause the diaphragm to vibrate and move the coils in the field of the magnet and thus generate a voltage in the coil. This assembly is almost universally used for high-quality sound. Thus, the dynamic microphone is especially suited for use in recording and in public address systems.

**GUIDELINES FOR MICROPHONE PLACEMENT.**—In recording sound, you must have the proper placement of the microphone.

If it is necessary to record speech in a room that is too “lively” (as in most classrooms and offices), the microphone should be brought as close as permissible to the speaker. In extreme cases, any sound-absorbing materials that may be available, such as coats, blankets, or burlap, could be suspended at the sides of the microphone about 3 feet away. Sound-absorbing material may also be placed on the floor and ceiling to absorb, as much as possible, the reflected sound coming from these directions. It is not necessary to absorb the reflected sound coming toward the back of a directional microphone.

Remember that in sound recording you cannot always place the microphone in the most advantageous position for ideal sound pickup. As a consequence, the microphone position is often a compromise. Remember to consider the position of both temporary and permanent acoustical materials when placing the microphone. It may be possible to improve sound reproduction by simply moving the position of the temporary acoustical materials. The following rules will prove helpful in microphone placement.

- Never place the microphone next to reflecting surfaces, such as tabletops and bare walls.

- When possible, use only one microphone to record dialogue.

- When two or more microphones are used, they should be approximately 10 feet apart.

Alertness and proper respect for the sensitivity of the microphone are essential when you are recording interviews and presentations. When recording presentations of participants who are seated around a table, you may place the microphone on the table near the center of the group. If all those present have an opportunity to enter into the discussion, be sure that you select an omnidirectional microphone to pick up speech waves from all directions. If a directional microphone is used, it must be handed around or the voices of some of the participants will not be recorded.

When confronted with a microphone, some people become nervous and begin tapping the table or making some other noise, which will be recorded. If the noise takes place when someone is speaking, it cannot be edited out. Therefore, individuals present should be reminded that they must keep unnecessary noises to a minimum.

To record the narration of one person, a lavalier-type microphone attached with a cord around the person's neck provides excellent results. This permits the individual to forget about the microphone, talk freely, and move about.

In placing microphones, you will at first have to depend upon your own hearing. But you must realize that the sound heard by your ears is different from that "heard" by a microphone. People possess the ability to concentrate their attention on a person who is speaking; though the room is filled with other people, they disregard extraneous sound. The microphone, on the other hand, has but one ear and that ear does not have the ability to reject unwanted sounds. Every sound that reaches the microphone is picked up. In placing the microphone, move it around to various locations and listen with one ear. In this way you will hear much the same as the microphone does. Thus, you will be

able to judge what the microphone will "hear" and place it in the best position.

## **Amplifiers**

After the microphone, the next link in the chain that makes up an audio system is the amplifier. After the sound is received by the microphone, it is fed into the amplifier. The amplifier receives this weak signal and boosts it until it can be heard with the aid of a loudspeaker. However, amplifiers are not necessarily separate units nor do they need a microphone. A motion picture projector has a built-in amplifier for its sound system. A tape recorder may also have a built-in amplifier. Usually, separate amplifiers are found in a public address system or in a recording studio where multiple microphones are used.

After sound is converted into electrical energy and amplified, a device must be used to convert this energy back into sound. This device is the loudspeaker.

## **Loudspeakers**

The loudspeaker, or speaker, converts electrical current variations into sound. Although various types of speakers have been developed and used at different times, the majority of those currently in use are permanent magnet dynamic speakers with impedance values between 3.2 and 16 ohms. They require only a two-wire connection to the amplifier.

The placement of the loudspeakers is largely determined by the type of presentation to be given. For example, when used with a motion picture projector, the speaker should be placed near the screen so that the sound and picture will come from the same direction. The placement of the loudspeaker in other situations should be given as much consideration as the placement of the microphone. The loudspeaker should face away from the reflecting surfaces, such as large tabletops and bare walls. Also, speakers should not be placed facing each other, facing large flat surfaces, or facing the microphone, because acoustic interference is certain to result. Single speakers or small groups of speakers should be

placed so that an imaginary line can be drawn from the center of the loudspeaker directly to the ears of most of the listeners. This means the audience should sit directly in front of the speaker. When the auditorium is extremely long and narrow, it may be necessary to distribute speakers among the audience so that those in the rear can hear. These loudspeakers should face toward the rear of the auditorium and their position must be determined by trial and error. In other situations, "play it by ear." Distribute your speakers and make a dry run before the audience arrives; reposition the speakers as required.

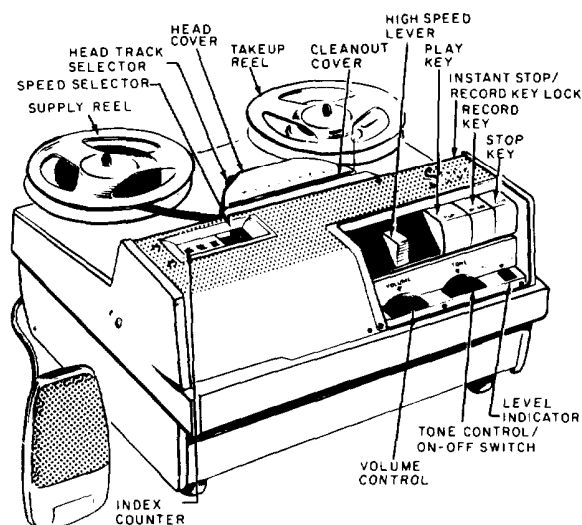
## AUDIO TAPE RECORDER

As a Religious Program Specialist, you may have the responsibility for recording and reproducing sound. The tape recorder is the equipment you will be using. This section will give you sufficient knowledge of the controls of the tape recorder to enable you to operate the recorder in both the record and the playback mode. Also, you will be given information which will enable you to clean and make minor repairs to the tape recorder.

### Operating Controls

Within the Navy, a number of makes and models of tape recorders are used. Although the aim of this discussion is to present tape recorders in general, one specific model will be used to illustrate the controls and operation of all tape recorders. Figure 7-19 illustrates the controls on a typical tape recorder. The controls on this model will differ only slightly from controls of other models of audio recorders.

**TONE CONTROL/ON-OFF SWITCH.**—Locate the tone control/on-off switch in figure 7-19. Rotating the tone control a few degrees clockwise turns the recorder on. This applies power to the amplifier and the tape transport motor. Turning this control adjusts the relative strength of bass, middle, and treble frequencies of program material. In the midrange or BALANCED TONE position, the very high and very low tones are emphasized, and the degree of emphasis varies with the volume control setting.



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Figure 7-19.—Audio recorder.

This gives a response which follows closely the normal hearing pattern of the human ear. In the BASS position the highs are subdued and the lows are emphasized. In the TREBLE position the higher frequencies are emphasized. The HIGH-FI position produces a response suitable for use with auxiliary equipment. The tone control has no effect when a recording is being made.

When the tone control is turned to the OFF position, a tab on the knob trips the transport mechanism, returning it to the STOP position for storage.

**VOLUME CONTROL.**—This control regulates the volume during recording and playback. It is also effective in regulating the signal level applied to a separate sound or music system through the preamp output jack.

**FUNCTION KEYS.**—Figure 7-19 shows three keys located in the upper right-hand portion of the front control panel. These keys are identified as the STOP key, RECORD key, and PLAY key. Pressing the STOP key cancels either the PLAY key or the RECORD key, applies brakes to the spindles, and holds the tape

away from the head, and the function switch is put in STOP position.

**CAUTION:** The record lock lever (shown in figure 7-19 as the instant stop/record key lock) must be pulled forward before the RECORD key can be depressed. This releases the brakes, holds the tape against the head by pressure pads, and pushes the pressure roller against the capstan and advances the tape. The function switch is then turned to the RECORD position. Depressing the play key causes the same action as the record key except that the function switch moves into the PLAY position.

**HIGH-SPEED LEVER.**—Locate the high-speed lever in figure 7-19. You will find it to the left of the function keys. Moving the high-speed lever to the right causes the tape to advance at a much higher speed than during normal record or playback operation. When the lever is moved to the left, tape is rewound onto the supply reel. The high-speed lever can be moved when the recorder is in any function (PLAY, RECORD, or STOP) and the play or record key will be automatically released. When the lever is returned to neutral, the recorder is left in the STOP position.

**INSTANT STOP AND RECORD LOCK LEVER.**—This lock lever is a safety feature to prevent accidental erasure of prerecorded tapes. It must be pulled toward the front of the recorder and held there before the record key can be operated. It also serves as an instant stop lever when the tape is in motion during record or playback. When the instant stop lever is pulled toward the front of the recorder, the tape drive is disengaged and the tape stops instantly. The recorder returns to its previous operation when the lever is released.

**RECORD-LEVEL INDICATOR.**—During recording operations, the left or "Normal" half of the indicator flashes to indicate a correct volume level and the right or "Distorted" half flashes if the volume setting is too high. If the volume level is preset for recording before the record key is pressed, the tone control should be turned to TREBLE. However, after the record

key has been pressed, the tone control adjustment has no effect. When playing prerecorded tapes, ignore the flashing of this indicator.

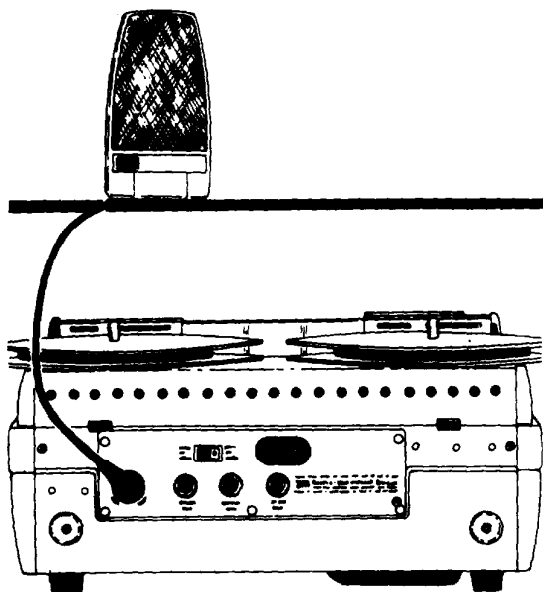
**SPEED SELECTOR.**—The speed selector is mounted near the index counter at the left front of the instrument, and determines whether the tape travels at 7-1/2 or 3-3/4 inches per second (ips) (19 or 9.5 ems). The speed being used appears on the speed selector dial. The recorder does not need to be stopped in order to change speeds. Rapid forward winding can be accelerated by setting the speed selector to 7-1/2 ips (19 ems).

**INDEX COUNTER.**—The index counter can be set to zero by turning the knurled knob toward the rear of the recorder. If the counter is zeroed when recording or playback starts, tape selections can be indexed, thus providing quick and accurate replay or editing.

**HEAD TRACK SELECTOR.**—Figure 7-19 shows the location of a head track selector. This is peculiar to models with a quarter-track stereo head. The quarter-track stereo head on this model tape recorder may be used to make either 2- or 4-track monaural recordings. This instrument will play back 2- or 4-track monaural and 2-or 4-track stereo tapes. To function properly, however, the head pole pieces must contact the tape at the proper level. The head track selector moves the head to the correct position when properly set and when the proper side of the tape reel is up.

There is a rear panel which contains some important controls. These are shown in figure 7-20 which is a drawing of the rear panel controls.

**RECORD MIKE/PUBLIC ADDRESS (PA)-MONITOR SWITCH.**—When this slide switch is in the RECORD MIKE position, the speaker does not operate when either the record or stop key is depressed. This is also true of any speaker which may be connected to the speaker output jack at the time. When the switch is in PA-MONITOR position, the speaker is connected so that the recorder can be used as a PA system or so that program material can be monitored as it is being recorded. The switch has



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Figure 7-20. Rear panel.

no effect when the recorder is in the PLAY mode.

**INPUT JACK.**—The input jack can be used to connect a microphone or radio/phono combination to the recorder. The proper input circuit is automatically selected by means of a different plug length for each application. A short (1-inch, 25-mm) plug is used with the microphone and a longer (1-3/16 inch, 30-mm) plug is used for the radio/phono connection.

**EXTERNAL SPEAKER JACK.**—An external speaker can be connected to the recorder by means of this jack. The nominal impedance of the speaker should be 8 ohms, but speakers of impedance ranging from 3.2 to 16 ohms may be used with only a slight loss of power. Accessories such as headphones may be used. The internal speaker of the recorder is automatically disconnected when a plug is inserted into the external speaker jack.

**PREAMP OUTPUT JACK.**—This jack is provided for direct connection to the playback

signal to an external audio system, bypassing the output stage of the tape recorder.

**STEREO PREAMP JACK.**—This jack is found only in models that play back prerecorded stereo tapes. The lower channel of a prerecorded stereo tape is fed out through the stereo preamp jack to an auxiliary amplifier and speaker system.

**POWER CONNECTION.**—The connection for the recorder power cord is located on the rear control panel. The recorder may be connected to a power source of 105- to 120-volts, 60-Hz, alternating current.

### Recording

For clean, cool operation, place the recorder on a hard, smooth, sturdy surface when operating. Connect the tape recorder to the power source indicated on the back panel of the recorder by using the power cord provided. Make sure the high-speed lever is in the center of the neutral position, then turn the recorder on by turning the tone control a few degrees clockwise.

**THREADING THE TAPE.**—Press the stop key. Remember that this brakes the spindles and creates a condition to hold the tape away from the play-record head. Place the full reel of tape on the left spindle and the empty reel on the right. Thread the tape so that the glossy side is out and the dull, oxide-coated side faces in and is against the heads. To thread the machine, pull a length of tape off the supply reel and lower it into the threading slot. Attach the end of the tape to the empty takeup reel. Be sure that any adhesive tape is removed if you are threading a new tape. Otherwise, when rewinding the tape, the end may stick and cause tape breakage. When the tape is attached to the takeup reel, set the index counter to zero for reference.

**RECORDING WITH A MICROPHONE.**—To record from a microphone, make the recording hookup as illustrated in figure 7-20. You will notice that the microphone plug is inserted firmly into the input jack at the rear

of the recorder. Set the record MIKE/PA-MONITOR slide switch to RECORD MIKE. Select the desired tape speed, usually 7-1/2 or 3-3/4 ips (19 or 9.5 ems), by means of the speed selector. If the recorder you are using is designed to use 4-track recordings on the tape, select the track on which you wish to record. This is done by setting the track selector to the proper track position.

If it is desired to set the recorder level before the tape is set in motion, turn the tone control to TREBLE and adjust the volume control until the "Normal" half of the indicator flashes and no flashing occurs at the "Distorted" half.

Pull forward the instant/stop record lock lever and press the record key. Release the instant stop lever, and recording will start. When the recording is finished, press the stop key.

The signal can be monitored during recording if the slide switch on the rear panel is set to PA-MONITOR. However, be careful to keep the microphone away from the speaker, or acoustic feedback may cause squealing. This feedback can be avoided if earphones are used instead of the speaker. Plug the earphones into the external speaker socket. When the recording is completed, rewind the tape by moving the high-speed lever to the left. Before rewinding the tape, you may record additional material by turning over the full takeup reel and placing it on the supply spindle.

**RECORDING FROM AN EXTERNAL AMPLIFIER.**—Recording can be made from external sources such as phonographs, radios, television sets, AM-FM Tuners, or other tape recorders. The outputs from these sources are commonly marked "Detector," "Tape," "Recorder Input," or "Preamp Output," and can be connected directly to the microphone-phonoradio input of the recorder. These external sources are connected to the input jack with a long (1-3/16 inch, 30-mm) plug. After the connection, the procedure is the same as when you record with a microphone. If the external amplifier has a level control for the output jack being used, it should be set so that the recorder volume will be somewhat near its midrange for proper operation of the level indicator. Tone controls and loudness controls on the external amplifier should be set as nearly as possible to feed a flat (or high-fidelity) output signal to the recorder.

**ERASING THE TAPE.**—When a monaural recording is made, any previously recorded material on the tape is automatically erased before the new material is recorded. Erasing is done only when the recorder is in the RECORD function. A half-track head (in all models that use half-track heads) erases only that half of the tape that is being used; a quarter-track head (characteristic of many models with 4-track recording capability) erases only one-fourth of the tape when a recording is being made. To erase a track without recording new sound, turn the volume control down before pressing the record key.

In all models designed to use 4-track tapes, the tape should be erased before recording if the tape will be played on a recorder which has a half-track head. This is necessary because during a recording such a model simultaneously erases and records only one-fourth the width of the tape (figure 7-21C); so there will be both old and new recordings on half of the tape the second recorder would play. Erasing can be done by running the tape through the recorder four times or by the use of a bulk tape eraser. The purpose of the erase head is to remove any previously recorded signal before the tape reaches the record head. The erase head acts as an electromagnet, with a field powerful enough to destroy whatever magnetic patterns happen to exist on the tape. As a given point on the tape recedes from the erase head, the powerful field in effect diminishes, gradually bringing that point on the tape to a demagnetized condition.

A tape consists of a coating of iron oxide on a base of mylar plastic. The iron oxide is easily magnetized and demagnetized. When the oxide is subjected to the magnetic field of the record head, the result is to create a series of bar magnets of varying lengths and depths on the tape. Long magnets correspond to low notes; short ones to high notes. Deep magnets correspond to strong recorded signals; shallow ones to weak signals. Each bar magnet has a south seeking pole and a north seeking pole, with an external magnetic field between the two poles. In playback the fields of the bar magnets excite the playback head.

The prevalent distinction among types of tape is in terms of thickness which determines the amount of tape that can be wound on a



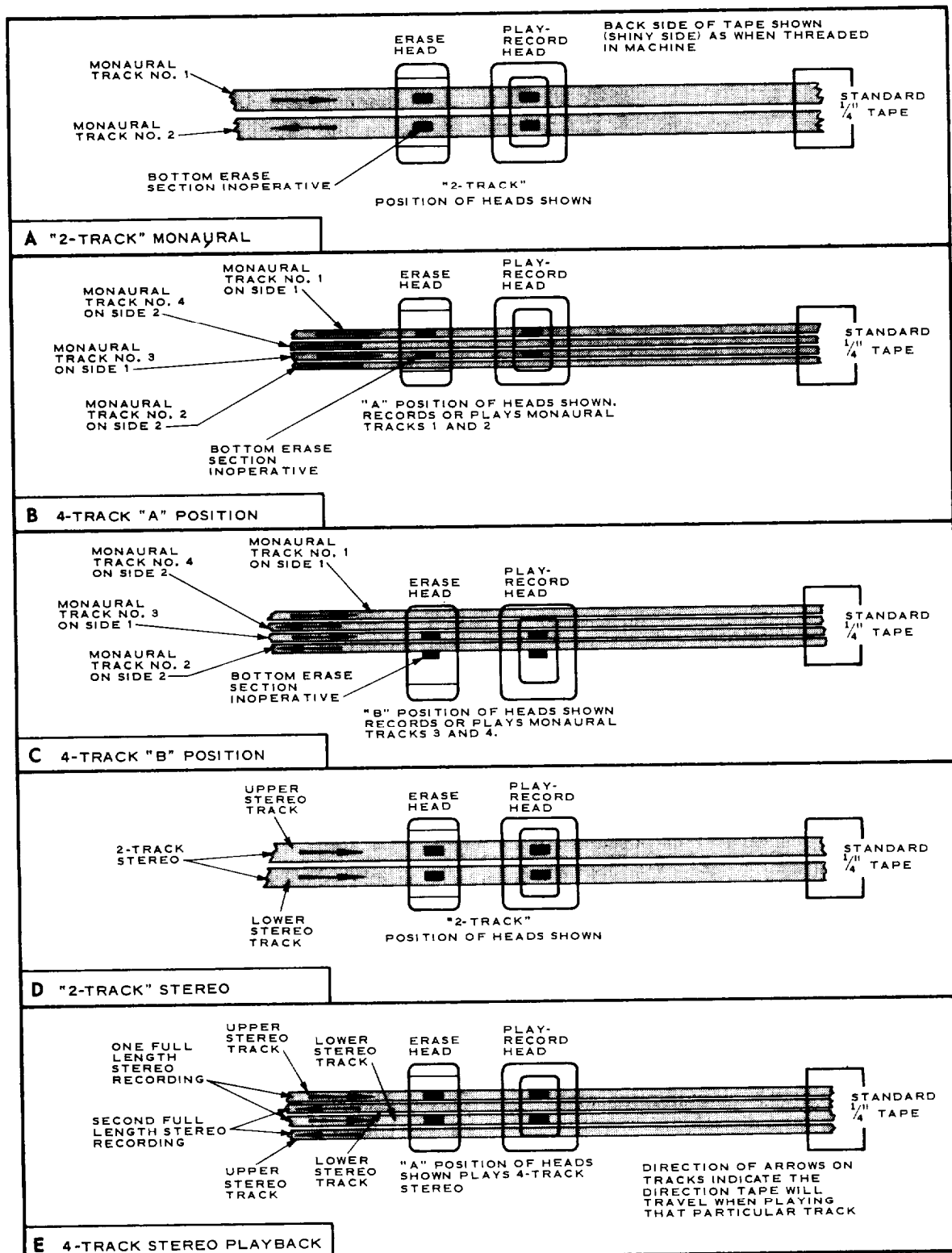


Figure 7-21.—Position of heads.

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7-inch (18-cm) reel and, consequently, the resultant playing time.

## **Playback**

To playback a recording, thread the tape and locate the desired starting point by using the high-speed lever. Set speed selector for the speed at which the tape was recorded. Push down the play key; then adjust volume and tone controls to suit.

**NOTE:** While modern recorders are almost foolproof, many a good recording has been destroyed by accidentally playing it on the RECORD position. Always use the correct control.

**MONAURAL.**—If the tape is a dual-track recording, turn over the takeup reel at the end of the first track and put it on the supply spindle. Rethread the tape and play it in the opposite direction.

When you are playing back a recording, you must be familiar with the recorder that you are using. Follow the instructions published in the operation manual for the specific recorder. Some recorders are capable of playing back 4-track recordings. The model shown is such a recorder. When playing a 2-track monaural recording on this specific model, set the head track selector on 2-TRACK. This positions the heads as shown in figure 7-21. When playing back 4-track monaural recordings, set the head track selector on "A" or "B" and run the tape in that direction which gives the desired track to be played. Figure 7-21 illustrates the "A" position of the heads. You will notice that in the "A" position, you can play back monaural tracks 1 or 2. Figure 7-21 also illustrates the "B" position of the heads. Notice that the "B" position permits you to play back monaural tracks 3 or 4, depending on tape direction.

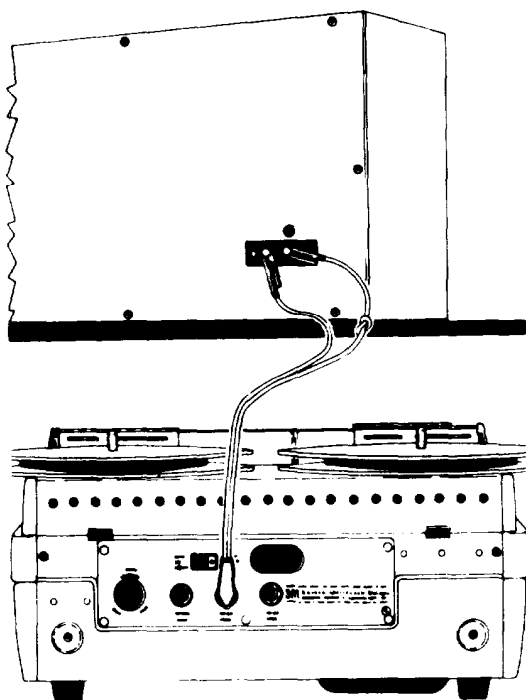
**STEREO.**—When you play music before or during a presentation, you may want to play stereo recordings. To play a stereo recording, connect the stereo preamp jack to an external amplifier and speaker system, placing the speaker at least 7 feet (2.3 m) to the right of the

tape recorder. If you use a stereo amplifier, connect the regular preamp output jack to the left channel input and the stereo preamp jack to the right channel input. In this arrangement the output stage and the speaker of the tape recorder are not used.

Thread the tape and locate the desired starting point. Remember that moving the high-speed lever to the right causes the tape to advance at a much higher speed than normal. Set the speed selector at the speed for which the tape was recorded. If you are playing back a 2-track stereo tape, set the head track selector on 2-track. Figure 7-21D illustrates the 2-TRACK position of heads for stereo 2-track playback. If you are playing back a 4-track stereo tape, set the selector on "A," Figure 7-21 E illustrates the "A" position of heads for stereo 4-track playback. After positioning the selector, push down the PLAY key and then adjust the volume and tone controls for proper balance.

When playing 2-track stereo tapes, you will have to rewind the tape at the end of the reel to prepare for the next playing. Figure 7-21D shows that the signals are put on the 2 tracks in the same direction. The 4-track stereo tapes contain additional program material; therefore, you may turn the full takeup reel over at the end of the first side and place it on the supply spindle. Figure 7-21 E illustrates that the program material is put on tracks 1 and 3 in opposite directions from tracks 2 and 4. After turning the reel, leave the head track selector knob set on "A" (figure 7-21 E). At the end of the second side this tape will be ready for the next playing without rewinding.

**PLAYBACK THROUGH EXTENSION SPEAKERS.**—Figure 7-22 illustrates connections to be made to play back through extension speakers. Plug the attachment cord phone plug firmly into the extension speaker output jack. This automatically silences the recorder's built-in speaker. Attach the alligator clips to the terminals of the extension speaker. It was pointed out previously that preferably the speaker should be of 8-ohm impedance, however, speakers of impedances ranging from 3.2 to 16 ohms may be used. Use the recorder volume and tone controls to control the extension speaker.



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Figure 7-22.—Playback through extension speaker.

### Minor Maintenance

You can expect to do very little maintenance on tape recorders. Occasionally, you may have to clean surfaces or change pressure pads but, as a rule, if more complicated maintenance is required, you should return the recorder to your maintenance department.

**PRESSURE PADS.**—If the pressure pads do not hold the tape firmly against the heads, poor sound will result. With the machine on and in the PLAY position, check to see if the two felt pads are worn or are not pressing the tape squarely against the head pole faces. When necessary, the felt pressure pads furnished for replacement may be cemented in place with household cement. The pads should cover the shiny pole faces of the heads, and the side of each pad touching the head must be free of cement.

**LUBRICATION.**—Generally, all moving parts of a tape recorder are permanently lubricated, and with normal use no further lubrication should be necessary.

### Cleaning

The majority of defects, other than wear or breakage, can be traced to dirty surfaces. The play-record and erase heads, capstan, and pressure roller are subject to an accumulation of tape coating residue, which is rubbed off the tape as it passes these parts. This accumulation will cause faint recording and poor playback and will impair the ability to erase. Therefore, the accumulation must be removed periodically. Remove the accumulation by wiping off the record and erase heads, capstan, and pressure roller with a clean cloth. If dirt is caked or hard and will not come off with a dry cloth, dampen the cloth slightly with alcohol.

